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BOUHELIER (R.) & HUDAULT (E.). **Contribution à l'étude du bromure de méthyle utilisé pour la désinsectisation des produits végétaux.**—*Bull. Chamb. Agric. Casablanca* **14** no. 149 pp. 9–33, 17 refs. Casablanca, 1943.

The authors describe the properties of methyl bromide as a fumigant, including its high toxicity to insects and low toxicity to man, and give an account of experiments with it carried out in Morocco over a number of years [*cf. R.A.E.*, A **23** 194]. The treatments were applied in horizontal cylinders, approximately 140–1,760 cu. ft. in volume, partly filled with the material to be treated or unrelated material containing samples of it. The gas was introduced through a single opening in the small chambers and through a tube running along the top of the cylinder in the large ones; the tube was pierced with holes that increased in size with the distance from the point of entry in order to obtain a more even diffusion of gas. When treatment was carried out at atmospheric pressure, a fan was sometimes used to mix the air and vapour. For treatment under reduced pressure, an initial partial vacuum of 60–65 cm. [about 24 in.] of mercury was produced and a mixture of gas and air was introduced to reduce the vacuum to 12 cm.; atmospheric pressure was restored after half an hour. All materials were aerated after treatment by having fresh air blown through them violently. In this abstract, all dosages are given in oz. per 100 cu. ft.

Tests with small numbers of living plants indicated that methyl bromide should be useful for controlling Coccids on them under partial vacuum, particularly in the case of many ornamental plants that are susceptible to hydrocyanic acid gas. Certain plants, however, appear to be injured by the dosages necessary to control insects attacking them.

From the results of fumigating dried fruit (figs, dates, raisins and bananas), it is concluded that treatment under a partial vacuum is effective against a number of insects at a dosage of 5 oz. for 1½ hours; for certain insects or very densely packed fruit the period should be extended to 2–3 hours. Fumigation of dried figs at atmospheric pressure with 2 oz. for 48 hours killed all larvae and pupae of *Ephestia*, *Myelois* and *Plodia interpunctella*, Hb., and larvae, pupae and adults of *Carpophilus hemipterus*, L. Numerous tests against *Bruchus* (*Acanthoscelides*) *obsoletus*, Say, in beans and *B. rufimanus*, Boh., in broad beans indicated that 2 oz. for 48 hours at atmospheric pressure is satisfactory; *B. obsoletus* was also controlled with 1 oz. for 72 hours. Complete mortality of *B. pisorum*, L., in peas was obtained by treatment at atmospheric pressure with dosages varying from 1 oz. for 72 hours to 3 oz. for 24; 5 oz. for 2 hours under reduced pressure was effective against all stages of *Pachymerus cassiae*, Gylh., in ground-nuts, except the larvae and pupae within the cocoons, to destroy which it was necessary to prolong the fumigation period to 3–4 hours, and at atmospheric pressure the minimum effective dosages were 2 oz. for 48 hours or 3 oz. for 24. Complete mortality of *Calandra oryzae*, L., was given by 1½ oz. for 72 hours in split peas and chick peas [*Cicer arietinum*] and 3 oz. for 24 hours in wheat placed in a pile of empty sacks or in ground-nuts, all at atmospheric pressure, and 5 oz. for 3 hours in split peas at reduced pressure. In banana flour, 4 oz. for 4 hours at reduced pressure gave complete control of larvae and adults of *Dinoderus bifoveolatus*, Woll., and adults of *Araecerus fasciculatus*, Deg., and *Tribolium* sp. Cipollini (*Muscari comosum*), which were an important export to America until 1939, were successfully treated for the control of *Exosoma* (*Malacosoma*) *lusitanica*, L. [*cf.* **28** 490] with 3 oz. for 24 hours at atmospheric pressure without damaging the bulbs, and it is considered probable that the dosage could be reduced. Potatoes are usually treated with 5 oz. for 2 hours under reduced pressure or with 1½–2 oz. for 24 hours at atmospheric pressure against *Gnorimoschema* (*Phthorimaea*) *operculella*, Zell. Treatment of dried fish with 2 oz. for 46 hours at

atmospheric pressure gave complete control of larvae and adults of *Dermestes frischi*, Kug., whereas treatment with 5 oz. for 1½ hours at reduced pressure gave only 82 per cent.

It is shown that fumigation with methyl bromide at atmospheric pressure retards the germination of seeds to a degree that varies with the species and the dosage, but is marked when the latter is higher than 2 oz. for 48 hours or 3 oz. for 24. It is, however, possible to destroy insects attacking the seeds without materially affecting their germinating power, provided that they are aerated soon after treatment. Under partial vacuum, fumigation with 5 oz. for 3 or 4 hours had no effect on the germinating power of ground-nuts. The odour of methyl bromide persists for some time in beans, lentils, chick peas, rice and wheat, particularly after treatment at atmospheric pressure, but no trace was found after cooking provided that they had been washed previously. The odour was also present in flour, but small-scale tests indicated that the treatment somewhat improved its baking quality.

Treatment under partial vacuum has the advantage of speed, but is expensive and troublesome and not always effective against insects in protected positions or in resistant developmental stages. Treatment at atmospheric pressure can be carried out with simple apparatus and sometimes gives more complete control, but it is necessary to see that the gas is well distributed and that the goods being treated are arranged in small lots with plenty of space round them.

BERGER (G.), BOUHELIER (R.) & HUDAULT (E.). **Contribution à l'étude du bromure de méthyle utilisé pour la désinsectisation des produits végétaux. Deuxième note.**—*Bull. Chamb. Agric. Casablanca* **15** no. 169 pp. 5–11. Casablanca, 1944.

An account is given of experiments in Morocco with methyl bromide applied by the methods previously used [*cf.* preceding abstract] against *Platyedra* (*Pectinophora*) *gossypiella*, Saund., in cottonseed in bags and *Dermestes frischi*, Kug., and *Necrobia rufipes*, Deg., in dried meat. At reduced pressure, a dosage of 5 oz. per 100 cu. ft. for 4 hours gave only 70–80 per cent. mortality of *P. gossypiella*, but dosages of the order of 2 oz. for at least 24 hours at atmospheric pressure gave complete kill of larvae within the seeds at temperatures above 16°C. [60·8°F.], and this was confirmed in large-scale tests, which also showed that it was unnecessary to introduce the compound equally throughout the chamber, to use a fan to distribute it, or to reduce the pressure before introducing the fumigant, though if these precautions are taken it may be possible to reduce the dosage or the period of exposure. Seed treated with dosages of 3 oz. or more for 24 hours showed a slight decrease in percentage and speed of germination.

Heavy infestations by *D. frischi* and *N. rufipes* in dried meat that had been stored for long periods were not completely controlled by fumigation under reduced pressure, even at dosages of 5 oz. for 6 hours, but fumigation at atmospheric pressure with 3 oz. for 18 or 24 hours gave complete kill of larvae, pupae and adults of both species, and the same result was obtained when large quantities of meat were fumigated with 3 oz. methyl bromide for 24 hours. It is presumed that the eggs also were destroyed, since no reinfestation occurred. The meat smelt of the chemical after treatment, but no odour could be detected and no traces of bromine compounds were found after it had been cooked. A dog that was fed on treated meat for several days showed no discomfort and no pathological symptoms.

RAUCOURT (M.) & BÉGUÉ (H.). **Formulaire phytopharmaceutique.**—*Monogr. Sta. Lab. Rech. agron.*, 205 pp., 13 figs. Paris, 1945. Price *Fr.* 45.

The first part of this handbook (pp. 3–61) comprises an alphabetical list of the substances that are most commonly used in France in the control of insect

and other pests of plants or as weed-killers, showing their composition and chemical and physical properties, methods of preparation, the uses for which they are employed and the quantities needed, materials used in agricultural practice with which they are incompatible, the authorised specifications for commercial products, the precautions to be observed during application, and antidotes in case of accidental poisoning. The appropriate methods of analysis are indicated by references to the second section of the book (pp. 63–144), in which these are described in detail. The third part (pp. 145–190) contains the text of legislation dealing with the manufacture, sale and use of insecticides, fungicides, etc., in France.

SPOON (W.). **Stuiven en spuiten met derris tegen de vlasthrips.** [Dusting and Spraying with Derris against the Flax Thrips.]—*Tijdschr. PlZiekt.* **46** no. 5 pp. 157–162, refs. Wageningen, 1940.

The author briefly reviews the good results given by derris sprays against *Thrips* [*lini*, Lad.] on flax in Holland in 1938 [*cf. R.A.E.*, A **27** 233] and describes further tests by L. Eigeman in 1939 in which flax was sprayed twice, on 22nd and 26th May, with a suspension of derris containing 0·01 per cent. rotenone at the rate of 45 or 90 gals. per acre, or dusted twice with derris dusts containing 0·75 and 1 per cent. rotenone at the rate of 22·5 lb. per acre on 22nd May and 45 lb. on 26th. The best results, judged from the condition of the plants on 16th June, were given by the stronger dust, which was very effective, but it was thought that the rates of application of the spray were too low for fair comparison. Nicotine [*cf. loc. cit.*] is no longer officially recommended for control of the thrips, and derris dusts are preferred to sprays. Recommended treatments comprise several applications in May and early June of a dust containing 0·5 per cent. rotenone at the rate of 67·5 lb. per acre or of one containing 1 per cent. rotenone at 45 lb.

ROEPKE (W.). **De rijpingsvreterij van den ooftboomspintkever, *Scolytus mali* Bechst. (Col.: Scolytidae).** [Maturation Feeding in the Fruit-tree Bark-beetle, *S. mali*.]—*Tijdschr. PlZiekt.* **46** no. 5 pp. 168–173, 3 pls., 7 refs. Wageningen, 1940. (With a Summary in English.)

The phenomenon of maturation feeding is well known in certain Scolytids in Holland [*cf. R.A.E.*, A **27** 396], but had not been recorded for those that infest fruit trees there. In June, 1940, however, adults of *Scolytus mali*, Bechst., were observed feeding in the axils of the spurs on three cherry trees in an orchard. The upper side of the spurs was preferred, and feeding ceased after four days. Some of the beetles paired in the course of feeding. The injured spurs dried up and dropped to the ground, and feeding by several beetles at the same site caused an exudation of resin. The beetles had emerged in the orchard from an apple tree that had been dead for several years, a dead pear tree and a plum tree that had died in the previous year. Observations on these three trees showed that the infestation was heavy. The brood galleries are described. Almost all the adults had emerged by the beginning of July, and they included a few examples of *S. scolytus*, F., from the apple tree and parasites of three species. One of the latter was identified as *Elachertus* (*Elachistus*) sp. and is assumed to have been *E.* (*E.*) *leucogramma*, Ratz., which is known to parasitise Scolytids.

VAN DER HELM (G. W.). **Proefnemingen ter bestrijding van de preivlieg in 1939 en 1940.** [Investigations on the Control of the Leek Fly in 1939 and 1940.]—*Tijdschr. PlZiekt.* **48** no. 1 pp. 17–26. Wageningen, 1942.

Serious injury to leeks in a district near Amsterdam in 1938 and 1939 was found to be due to combined attack by *Hylemyia* (*Chortophila*) *antiqua*, Mg.,

which infests the underground parts of the plants, and the Tineid, *Acrolepia assectella*, Zell., which mines the leaves, the percentage of injured plants in some cases reaching 80–90. Since the control measures recommended in the Dutch literature were largely confined to the destruction of infested plants, experiments were carried out in 1939 on the value against *H. antiqua* of mercurous chloride (calomel) used as a seed dressing. The seed was first wetted with a 5 per cent. solution of glue and then mixed with an equal weight of mercurous chloride until it was evenly covered. Treated and untreated seed was sown at the end of March and the beginning of April in four different areas. The treated seed germinated better than the untreated in three of the areas, while there was no difference in the fourth. Damage by *H. antiqua* did not become apparent until 19th–24th June, and, on the only plot for which results are given in detail, counts on 7th July showed that the percentage infestation was 4·2 for the treated group and 27·7 in the control. The percentage of plants that were too small to be transplanted was 29·6 in the control and 61·3 in the treated group, and this high figure is attributed to the improvement in germination and consequent crowding among the latter. The suitable plants in both groups were then planted out in the field, and attack by leaf-miners, probably including *A. assectella*, began a fortnight later. It was about equal in the two groups, and many plants were dead or injured by the end of July, after which the attack diminished.

In 1940, treated seed was distributed to growers and sown between 21st and 30th March. Observations on 20th May showed that the treatment did not improve germination and in some cases reduced it, probably owing to dry weather following sowing or to the fact that starch paste had been used as the adhesive, but the percentage infestation on 10th June averaged only 2 among treated groups, as compared with 48·8 in the controls. At the beginning of July, the percentages of plants that were fit for transplanting, were attacked or were too small for transplanting averaged 57·1, 3·7 and 39·2 for the treated groups and 45·2, 29·8 and 25 in the controls. A final count was made at the end of July in the fields of set plants, and the percentage of cases in which treatment had given good results was then 34, which indicated that infestation had continued to some extent after transplanting.

Good results were also given by watering the soil round plants in the field in the second half of July and again in the first half of August with a solution of mercuric chloride (sublimate) (1 : 1500), at the rate of about 3 pints to 10 plants, which gave only 5 per cent. unmarketable plants, as compared with 65 per cent. in the controls. Incidental observations in the course of the year indicated that infestation could be reduced by sowing in light sandy soils and in sheltered positions. Infestation was light or negligible in plants sown under glass and less on the north side of hedges than on the south.

A subsidiary experiment was carried out in 1940 on the control of leaf-miners in the crop, particularly *A. assectella*. Dusting with mercurous chloride or with derris powder (0·5 per cent. rotenone) was unsatisfactory, but watering the hearts of the plants in the first and third weeks of August with a solution of mercuric chloride (1 : 1500) gave 95 per cent. marketable plants, as compared with none in an untreated plot.

KÖRTING (A.). **Untersuchungen über die Lebensweise der Möhrenfliege.** [Investigations on the Bionomics of the Carrot Fly.]—*Arb. phys. angew. Ent.* **7** no. 3 pp. 209–232. [1940.] (Abstr. in *Tijdschr. PlZiekt.* **48** no. 1 pp. 29–30. Wageningen, 1942.)

Observations on the bionomics of the carrot fly [*Psila rosae*, F.] in Saxony showed that overwintering occurs in both the larval and the pupal stage. Feeding by the overwintered larvae ceases in the first half of April, and they then pupate. The first adults emerge at the beginning of May. These move

to new fields of carrots in June, and oviposition continues from June onwards, sometimes until August. Young larvae are present in the roots in some years as early as the end of June, but injury does not become serious until August. Some of the pupae give rise to adults at the end of August and in autumn, and some overwinter. The females that emerge early enough oviposit in September, and the resulting larvae cause further damage to the crop. Some of them pupate in the autumn, but others overwinter before becoming full-fed.

VOÛTE (A. D.) & PELSMA (C.). **De lariksbladwespen in Nederland.** [Larch Sawflies in Holland.]—*Tijdschr. PlZiekt.* **48** no. 2 pp. 63–68 Wageningen, 1942.

As a result of increased plantings of larch in Holland, damage to this tree by insects that were previously rare is increasing. It was until recently thought that the only sawfly involved was *Pristiphora* (*Lygaeonematus*) *laricis*, Htg., but it is now known that five other species are present. These are *Cephaleia alpina*, Klug, which is the most injurious, *P.* (*L.*) *wesmaeli*, Tischb., which also probably causes appreciable injury, and *P.* (*Nematus*) *erichsoni*, Htg., *Platycampus ovatus*, Zadd., and *P. pectoralis*, Lep., which are of little or no importance. A key is given to the larvae of these six species, together with brief notes on their bionomics and distribution and the appearance of some of their stages. Larch has great regenerative power and soon recovers even after complete defoliation, but there is some risk of mortality if defoliation is followed by attacks of other pests.

ESCHERICH (K.). **Die Forstinsekten Mitteleuropas. Fünfter Band. Hymenoptera (Hautflügler) und Diptera (Zweiflügler).** [The Forest Insects of Central Europe. Vol. V. Hymenoptera and Diptera.]—9½×6¾ ins., x+746 pp., 3 col. pls., 715 figs., many refs. Berlin, Paul Parey, 1942.

Owing to the great advances in knowledge of forest insects that have been made in recent years, the author has not found it possible to complete this work in one further volume, as was intended [*cf. R.A.E.*, A **19** 372], and has issued this fifth volume, dealing with the Hymenoptera and Diptera, before the fourth, which is to contain the remainder of the Lepidoptera and the Hemiptera. The matter is arranged largely as before, and in the case of the parasitic species, emphasis is laid on their bionomics and the factors affecting their numbers rather than on systematic aspects.

JARY (S. G.) & ROLFE (S. W.). **The Leek Moth.**—*Agriculture* **52** no. 1 pp. 35–37, 1 pl. London, 1945.

Acrolepia assectella, Zell., all stages of which are very briefly described, was recorded, for the first time in England, on leeks and onions in Sussex in 1943 [*R.A.E.*, A **32** 226], and more extensive infestations were found in coastal areas of Sussex, Kent and east Hampshire and in the Isle of Wight in 1944, possibly owing to further immigration from Europe. Preliminary observations on its bionomics have shown that the overwintered adults become active in late April or early May and oviposit on the food-plant at or near ground level, and the eggs hatch in 5–8 days. On leeks, the larvae enter the leaves and make elongate mines, which appear white and which split as the leaves grow. The older larvae bore in all directions through the folded central leaves, and these, when expanded, show numbers of small feeding holes. After feeding for about three weeks, the larvae pupate in loosely spun cocoons on dead leaves or other dry material. The moths emerge throughout July and give rise to a second generation, the adults of which overwinter. Damage by the larvae is followed by extensive rotting, caused partly by secondary insect attack, so that the

plants may be almost completely destroyed. Injury to onions is apparently less severe. The young larvae, after slight mining, usually penetrate near the tips and feed inside the hollow leaves. They may sometimes eat through to the exterior again, but generally the attacked areas appear as pale spots. The larvae may enter the bulb as the foliage dies down, thus permitting the entry of rot organisms. Shallots and Welsh onions are attacked in a similar way. The larvae also feed in the seed heads of both onion and leek at the point where the flower stalks join the stalk of the inflorescence. As a result, all or most of the seed head may fall, especially in windy weather, and the formation of seed be almost completely prevented. Infested heads may be recognised by the presence of green excrement at the base of the flower stalks.

Tentative suggestions are made for control, based on limited experience in England and recommendations elsewhere. On leeks, especially in seed-beds, a 4 per cent. nicotine dust and a spray containing 1 fl. oz. 98 per cent. nicotine in 10 gals. water have given good results and should be applied three or four times at intervals of not more than a week, beginning towards the end of May, when the larvae are young. Seedling leeks may be immersed in the spray fluid before transplanting, the soil being first removed from the roots. No satisfactory measures are known for control on onions and plants grown for seed.

KASSANIS (B.). **A Virus attacking Lettuce and Dandelion.**—*Nature* **154** no. 3896 p. 16, 1 ref. London, 1944.

A disease of lettuce reported from different parts of Britain during the past three years has been found to be due to the virus that causes chlorotic rings and spots in dandelion (*Taraxacum officinale*). The name dandelion yellow mosaic virus is suggested for it, as dandelions are likely to be the source of infection for lettuce. The primary symptom in lettuce plants appears 1–2 weeks after they are infected and consists in the development of fine necrotic areas along and between the veins of the young leaves. In glasshouse plants this is followed by chlorosis, dwarfing and malformation, but necrosis is the major symptom in outdoor plants, whole leaves becoming black and shrivelled. The virus can be transmitted by inoculation only if an abrasive is present in the inoculum; it has been transmitted by *Myzus ornatus*, Laing, and *Macrosiphum solani*, Kalt. (*Myzus pseudosolani*, Theo.), but not by *Myzus persicae*, Sulz., the vector of lettuce mosaic, which is a less severe disease. The Aphids do not transmit the virus unless they have fed on infected plants for at least three hours, and the number that become infective increases directly with the duration of the feeding period. They cease to be infective within an hour, even after feeding on the source of infection for as long as three days.

SMITH (K. M.). **Transmission by Insects of a Plant Virus Complex.**—*Nature* **155** no. 3928 p. 174, 4 refs. London, 1945.

Studies on the rosette disease of tobacco that has been recorded from Southern Rhodesia [*cf. R.A.E.*, A **27** 226, etc.] have shown that it is caused by the combined effect of two undescribed viruses, for which the names "vein-distorting virus" and "mottle virus" are suggested. The first of these is dependent on an Aphid vector, but the mottle virus is readily transmitted by sap inoculation. It differs from other viruses in its insect relations, since all attempts to obtain transmission by Aphids were unsuccessful unless they had fed on a plant also infected with the vein-distorting virus. In one such experiment in which examples of *Myzus persicae*, Sulz., were transferred from a tobacco plant infected with the mottle virus only to 12 healthy tobacco seedlings, 5–10 Aphids being placed on each, all the seedlings remained healthy. The original plant was then infected by means of Aphids with the vein-distorting virus, and when it had developed symptoms of rosette disease,

uninfected Aphids were allowed to feed on it. These were subsequently transferred to 12 healthy tobacco seedlings, one being placed on each, and nine of the plants later developed symptoms of rosette disease. It was further found that Aphids infected with both viruses transmitted either or both to as many as 20 plants in successive transfers at 24-hour intervals without further access to a source of infection. The results of dilution tests did not support the theory that a greater quantity of the mottle virus is present in plants showing symptoms of rosette disease than in those showing symptoms of the mottle virus only.

KVÍČALA (B.). **Selective Power in Virus Transmission by an Aphis.**—*Nature*, **155** no. 3928 pp. 174–175, 4 refs. London, 1945.

In experiments on the transmission by Aphids of viruses affecting crucifers, examples of *Myzus persicae*, Sulz., and *Brevicoryne brassicae*, L., that had fed on cauliflower seedlings infected with both cabbage black ringspot (*Brassica* virus 1), and cauliflower mosaic (*Brassica* virus 3 [*Marmor cruciferarum* of Holmes]) later transmitted both viruses, but *Myzus ornatus*, Laing, similarly infected transmitted only the second.

GADD (C. H.). **Shot-hole Borer Damage and Tea Yields.**—*Tea Quart.* **17** pt. 1 pp. 2–11, 2 figs., 6 refs. Talawakelle, 1944.

Much of the information in this account of work in Ceylon on the effect of manurial treatments on the yield of tea and the correlation between the latter and damage by the shot-hole borer [*Xyleborus fornicatus fornicatior*, Egg.] in the third year of a three-year pruning cycle ending in September 1943 has already been noticed [*R.A.E.*, A **33** 294]. The numbers of broken branches collected after each plucking during the whole of the third year and the last half of it were less than one-third and about one-seventh, respectively, of the numbers in the whole and last half of the second. It is estimated from the fresh weight of the broken branches collected at intervals in 1942 and 1943 that the total weight of branches removed during the three years was 1,268 lb. per acre; some indication of the extent of the damage is afforded by the fact that the average dry weight of prunings from clean-pruned bushes at the end of a three-year cycle at a place where the borer does not occur is 8,000 lb. per acre. Examination of the contents of the galleries at the fractures showed that the percentage occupied decreased from 10·9 in September 1942 to 1·9 in April 1943, and then increased, and the figures for galleries in unbroken branches, though greater, followed a similar trend. This late attack, which apparently caused little damage, corresponded with the period of maximum infestation in 1942.

These investigations showed that damage by *Xyleborus* is influenced less by manurial treatments than by the period that has elapsed since pruning. The number of branches broken during plucking, and therefore likely to be broken during pruning, is high at the end of the second year and then decreases. The yield per acre during the third year exceeded the average for the first two years by 60 lb. It is therefore suggested that the prolongation of the pruning cycle beyond the normal two years might be advantageous in some areas infested by *Xyleborus*.

Insect Pests.—*Agric. Gaz. N.S.W.* **56** pt. 1 pp. 21–24, 33, 8 figs., 1 ref. Sydney, 1945.

In this part of a series on insect pests in New South Wales [*cf. R.A.E.*, A **33** 268], it is reported that adults of *Dacus* (*Strumeta*) *tryoni*, Frogg., emerging in a greenhouse in early November from loquats collected in October were

attracted in numbers to the tendrils and leaves of climbing bean plants of the variety Pale Blue Lake and were trapped by the fine sharply-hooked hairs that cover the plants, particularly on the lower surface of the leaves; these are more numerous than usual on this variety.

Examination of the roots of unhealthy *Citrus* trees in an orchard in which adults of *Pantomorus godmani*, Crotch, had been abundant for several years and had sometimes caused extensive leaf injury showed that practically no fibre roots were present and that the long roots were almost devoid of feeding roots and were in many cases fairly extensively gouged and channelled in short lengths. Larvae of the weevil were found in the vicinity of the roots and were almost certainly responsible for the damage.

WEBSTER (R. L.) & others. **Entomology.**—*Bull. Wash. agric. Exp. Sta.* no. 455 (54th Rep. 1943–44) pp. 36–42. Pullman, Wash., 1944.

In laboratory tests carried out in eastern Washington in 1944 on dusts for the control of *Crioceris asparagi*, L., on asparagus, rotenone and sabadilla both gave a knockdown in a few minutes and complete mortality, and DDT, although slower in action, also resulted in complete kill. In field tests, dusting with these materials, nicotine or pyrethrum gave satisfactory control; nicotine was the most rapid in action. Dusting with 10 and 20 per cent. sabadilla or 3 per cent. DDT at intervals of 10 or 14 days gave good control of *Anasa tristis*, Deg., on squash, though some bugs were still alive 24 hours after treatment with DDT. The Tachinid parasite, *Trichopoda pennipes*, F., which was introduced into the Yakima Valley in 1943 for the control of this Coreid [*cf. R.A.E.*, A **33** 21], was recovered in 1944, and further liberations were made in this valley and at Clarkston. The damage caused by potato flea-beetles [*Epitrix*] in eastern Washington was greatest in fields of early potatoes that followed tomatos or late potatoes grown in 1943. Satisfactory commercial control was given by 3–5 applications of dusts of cryolite or calcium arsenate [*cf.* **33** 22], and damage by Aphids was somewhat less in fields dusted with cryolite than in those treated with arsenicals. In field-plot tests in which four and five applications of dusts containing 25 or 40 per cent. calcium arsenate, 35 per cent. cryolite or 31·5 per cent. sodium fluosilicate were compared, all gave satisfactory commercial control, but five applications of cryolite or 25 per cent. calcium arsenate were significantly better than four of the same materials. In another field in which the green peach Aphid [*Myzus persicae*, Sulz.] became numerous and the size and yield of potatoes was affected by leaf roll [*Corium solani* of Holmes], three applications of a 33·3 per cent. cryolite dust gave significantly better control of flea-beetles and a greater yield of marketable potatoes than three of a 25 per cent. calcium-arsenate dust. In other tests, a 25 per cent. lead-arsenate dust was inferior to one of 25 per cent. calcium arsenate against flea-beetles, and four applications of a spray of 4 lb. cubé (4 per cent. rotenone) per 100 U.S. gals. water was no more effective than four of a spray of 4 lb. cryolite and 1 U.S. pint linseed oil per 100 U.S. gals.

Infestation by *Ceuthorrhynchus assimilis*, Payk., of cabbage grown for seed in western Washington [*cf.* **33** 22] varies considerably from district to district and from season to season. In field tests, a concentrated pyrethrum dust reduced the percentage of seed destroyed to 1·5, as compared with 13 in the controls, while dusts of lead and calcium arsenate were progressively less effective. Five applications of any of these dusts are apparently necessary for control, since oviposition continues from late April or early May to mid-June. The Chalcidoid parasites, *Trichomalus fasciatus*, Thoms., and *Necremnus duplicatus*, Gah., cause 11–23 per cent. mortality of the weevil during the year, but do not give sufficient control. Dusts containing 3·6 per cent. nicotine were effective against *Brevicoryne brassicae*, L., on cabbage, and the addition

of 4 lb. calcium arsenate per 50 lb. dust resulted in the control of the flea-beetles that often infest the plant beds in destructive numbers. Pyrethrum dusts gave only 40–50 per cent. control of the Aphid and rotenone-bearing dusts only 5–10 per cent. Its natural enemies include an important Hymenopterous parasite, *Diaeretus rapae*, Curt., Syrphid and Coccinellid larvae, and a fungus that destroys entire populations in late summer and autumn. Some varieties of cabbage showed a marked tolerance of Aphid attack. A dust of mercurous chloride (calomel) in gypsum or lime (2 : 3) gave 98–99 per cent. control of *Hylemyia brassicae*, Bch., when distributed along the rows of seedling cabbages three times at the rate of 1 lb. per 100 ft. of row, and a concentration of 1 : 24 gave 88–90 per cent. ; a calomel-bentonite suspension in water (1 oz. calomel in 10 U.S. gals.) gave 95 per cent. The fly apparently has four generations a year in western Washington, and larvae of the last generation cause severe damage to transplanted cabbages in late summer and early autumn.

In the course of investigations on the natural control of crop pests by parasites, *Macrocentrus ancylivorus*, Rohw., which was liberated in San Juan, Skagit and Whatcom counties against the pea moth [*Cydia nigricana*, Steph.] in 1936 and 1943, was not recovered from it in 1944, and *Ascogaster quadridentata*, Wesm., and *Glypta haesitator*, Grav., which had been successfully introduced against it into British Columbia [*cf.* **32** 263], were not found across the frontier in Whatcom county. *Ephialtes* (*Scambus*) *hispae*, Harr., *E.* (*S.*) *aplopappi*, Ashm., and *E.* (*Epiurus*) *pterophori*, Ashm., emerged in 1944 from the pods of various leguminous plants collected in 1943 and infested with larvae assumed to be those of *C. nigricana*.

In a study on the possibility of reducing the quantities of lead arsenate used against the codling moth [*Cydia pomonella*, L.] on apple, sprays of 3 lb. per 100 U.S. gals. with 0·25 or 0·5 per cent. petroleum oil were applied at intervals of 10 and 14 days and when 163 effective day-degrees had accumulated. This resulted in the application of eight, six and eight cover sprays, respectively, during the season. Periodic examination of fruits on the trees showed that the sprays containing the higher proportion of oil, which acted as ovicide, were about 50 per cent. more effective than the others. Ten-day, day-degree and 14-day timing were effective in that order, but six sprays containing 0·5 per cent. oil were better than eight containing 0·25 per cent. Cryolite was more effective than lead arsenate when used in all cover sprays, and programmes in which it was substituted for lead arsenate against either the first or the second generation were as effective as complete programmes of lead arsenate. An examination of harvested fruit failed to show any significant difference in damage by *C. pomonella* when the trees were scraped and banded and the thinned fruits dropped on the ground and when the trees were not scraped or banded and the thinnings were immersed in oil to destroy the eggs and young larvae. The value of so treating the thinnings is probably greater in a heavy infestation than in a light one and when thinning is done late rather than early in the season.

Dormant sprays containing 3 per cent. petroleum oil, 10 per cent. lime-sulphur or 1 or 2 per cent. oil with 3 per cent. lime-sulphur applied to apple and pear against mites [*cf.* **33** 285] and the San José scale [*Quadraspidiotus perniciosus*, Comst.] all gave excellent control of the scale, but had no apparent effect on the Pacific mite [*Tetranychus pacificus*, McG.] on the apple trees. On the pear trees, infestation by the rust mite [*Phyllocoptes schlechtendali*, Nal.] on 17th August averaged 2·7, 1·8, 0·4 and 0·6 per leaf, respectively, and infestation by the blister mite [*Eriophyes pyri*, Pgst.] was low on all plots, but heaviest on those sprayed with the mixture of 2 per cent. oil and 3 per cent. lime-sulphur. The ammonium salt of dinitro-o-cresol and the dicyclohexylamine salt of dinitro-o-cyclohexylphenol, added to sprays of lead arsenate or cryolite, gave excellent control of the eggs and active stages of *T. pacificus* at

concentrations of 1 oz. per 100 U.S. gals. spray, and the addition of ¼ and ⅓ oz., respectively, improved the control given by petroleum oil in these sprays, but 1 oz. of either salt combined with 0·25 per cent. oil and lead arsenate or cryolite scorched the foliage when applied as the first cover spray, and their use with lead arsenate or cryolite proved inadequate for the control of *C. pomonella*.

There was no general extension of the area infested by the pear psylla [*Psylla pyricola*, Först.] in Washington in 1944, but one infestation was found in Oregon and some as far north as Summerland in British Columbia [*cf.* **33** 142]. Infestations and all trees within a radius of a mile of them were sprayed.

ANDERSON (E. J.) & others. **Plant Pathology.**—*Bull. Wash. agric. Exp. Sta.* no. 455 (54th Rep. 1943–44) pp. 64–71. Pullman, Wash., 1944.

In a section on virus diseases of potato (pp. 65–66) L. K. Jones records that leaf-roll in Washington did not differ materially from the typical leaf-roll [*Corium solani* of Holmes] in the eastern United States. The virus was transmitted in Washington by three species of Aphids [*R.A.E.*, A **33** 40], but not by six other species of Hemiptera taken on potato. The period between inoculation and the appearance of symptoms in the plants was 24–30 days.

J. D. Menzies reports (p. 68) that transmission experiments with the witches' broom virus disease of lucerne [*Chlorogenus medicaginis* of Holmes], which is present in the Methow and lower Yakima Valleys, indicate that the leafhopper, *Platymoideus acutus*, Say, is a vector.

SINGLETON (H. P.) & others. **Irrigation Branch Experiment Station.**—*Bull. Wash. agric. Exp. Sta.* no. 455 (54th Rep. 1943–44) pp. 77–86. Pullman, Wash., 1944.

In a section dealing with investigations on the control of *Limonius canus*, Lec., and *L. californicus*, Mannh., in irrigated land in eastern Washington (pp. 82–84), M. C. Lane, W. C. Cook & E. W. Jones report that the average of the combined population of the two wireworms in 1944 (2 per sq. ft.) in plots under observation each year was not significantly different from that in 1943 [*cf. R.A.E.*, A **33** 23], although *L. canus*, which comprises about 80 per cent. of the total population, appears to be increasing. This species is more abundant in wheat, potatoes, maize and sugar-beet than in lucerne, whereas *L. californicus* is more numerous in lucerne and wheat than in potatoes, maize or sugar-beet. The average wireworm populations per sq. ft. for 1944 were 1·5 in a rotation of four years of lucerne followed by three years of annual crops of potato, sugar-beet or maize, 2·9 in a rotation of three years of lucerne followed by two years of annual crops (potato and maize), and 2·4 in a rotation of alternate crops of potato and wheat, sugar-beet or maize or of maize and wheat or sugar-beet, indicating that the seven-year rotation affords the best control. In it, wireworm damage to potato is reduced to a minimum, particularly when this crop directly follows lucerne.

In preliminary tests in which ½, 1 or 2 gm. crude naphthalene per linear foot of row was placed 2 ins. below the seed at the time of sowing maize and lima beans, wireworms caused least damage where the heaviest application was made. It was found unsafe to place naphthalene in contact with the seed, as the latter was killed by concentrations above ½ gm. per foot. When naphthalene was placed 2 ins. below the seed at the rate of about 64 lb. per acre for maize sown in rows 36 ins. apart and at the rate of about 88 lb. per acre for lima beans in rows 22 ins. part, wireworm damage to the seed was reduced.

OVERLEY (F. L.). **Tree Fruit Branch Experiment Station.**—*Bull. Wash. agric. Exp. Sta.* no. 455 (54th Rep. 1943–44) pp. 87–92. Pullman, Wash., 1944.

Some of the information in this report on work in Washington in 1944 has been noticed from the main one [*R.A.E.*, A **34** 72]. In preliminary tests on

apple, a commercial preparation of DDT in petroleum oil applied at two concentrations in summer, did not give adequate control of the San José scale [*Quadraspidiotus perniciosus*, Comst.] and resulted in a considerable increase in the population of the Pacific mite [*Tetranychus pacificus*, McG.] [*cf.* **32** 386], with some indication of an increase in infestation by the woolly aphis [*Eriosoma lanigerum*, Hsm.]. Some applications caused injury to the foliage. Control of the codling moth [*Cydia pomonella*, L.] was very promising.

Crowley (D. J.). **Cranberry-Blueberry Laboratory.**—*Bull. Wash. agric. Exp. Sta.* no. 455 (54th Rep. 1943–44) pp. 92–94. Pullman, Wash., 1944.

The best of the substitutes for rotenone or pyrethrum tested in experiments on the control of cranberry insects, including the fireworm [*Rhopobota naevana*, Hb.] and the fruitworm [*Mineola vaccinii*, Ril.], in Washington in 1944 was pyrethrum marc, the residue left after the pyrethrum concentrate has been extracted from the flowers. The pyrethrin content of this material varies considerably, and 8–9 lb. had to be used per 100 U.S. gals. spray. Excellent control of *R. naevana* was obtained with a suspension of DDT (2 lb. per 100 U.S. gals. water), prepared by sifting the DDT into the spray tank with the agitator in operation. Most of the larvae died within ten minutes of being hit by the spray, and the residue on the plants was still effective after three weeks, although sprinklers had been used in the meantime. Some of the suspension that was kept in an open container from 30th May until 1st August had apparently lost none of its effectiveness. The same spray also gave good control of *M. vaccinii* and of the San José scale [*Quadraspidiotus perniciosus*, Comst.] in the migratory stage. DDT caused no injury to the plants during the growing season, except where it was used in combination with oil, when it caused a reduction in the size of the berries and increased leaf drop.

Breakey (E. P.) & others. **Western Washington Experiment Station. Entomology.**—*Bull. Wash. agric. Exp. Sta.* no. 455 (54th Rep. 1943–44) pp. 117–125. Pullman, Wash., 1944.

Some of the information in this report of work in western Washington in 1944 has been noticed from the main one [*R.A.E.*, A **34** 72]. Sprays of 3–4 lb. lead arsenate and 1 U.S. quart summer oil emulsion per 100 U.S. gals. spray applied to cherry between 25th and 30th May and again about two weeks later controlled *Rhagoletis cingulata*, Lw., and *R. fausta*, O.-S. [*cf.* **33** 23], and also protected the fruit from attack by *Cydia* (*Grapholitha*) *packardi*, Zell. The use of oil emulsion in the spray is apparently essential in western Washington, where the frequent rains, common during the critical period, dissipate an ordinary spray cover. A neglected orchard that received three applications of this spray in 1943 and two in 1944 had an infestation of 10–14 fruit-fly larvae per lb. fruit in the first year, but bore a marketable crop in the second, indicating that it takes two years to bring a heavy infestation under control. Fruits of the Lloyd George variety of raspberry that were hardened and misshapen were found to be infested by the Eriophyid, *Phyllocoptes gracilis*, Nal. On one planting, half the plants bore infested fruit. Other varieties appeared to be less affected.

Phyllotreta columbiana, Chitt., causes considerable injury to small tender cabbages before and after they are transplanted from the seed-beds and may kill or injure 50–70 per cent. in a few days. It can be controlled with calcium arsenate or rotenone-bearing dusts, but they must be applied before much damage has been done. Ploughing the old seed fields immediately after threshing aids in control, as these become sources of fresh infestation. *Pieris rapae*, L., *Plutella maculipennis*, Curt., and *Plusia* (*Autographa*) *brassicae*, Ril., are of minor importance to the cabbage-seed industry in the Skagit Valley, and no

control measures have so far been required. Tests in 1943 indicated that young cabbage plants can be successfully fumigated with methyl bromide at a dosage of 2 lb. per 1,000 cu. ft. for three hours to kill any insects present when they are transplanted. Studies on the cabbage seed-pod weevil, *Ceuthorrhynchus assimilis*, Payk., showed that in 1943 the adults emerged from hibernation principally in the middle of April during ten consecutive days with maximum temperatures above 60°F. In April 1944, there were only five days with temperatures above 60° scattered through the month, and emergence was gradual and did not reach a peak until the end of April. No eggs were found in pods less than 2·25 mm. in diameter (¾–1 in. long). Adults fed on buds, flowers and developing seed-pods and oviposited from late April or early May until late July or early August. Larvae were found in the pods until early September. The first larvae became full-fed towards the end of June, and the majority in July. They dropped to the ground and formed cells of soil particles within which to pupate. The adults left the soil soon after emergence and fed for a time, frequently on green pods or on the thicker veins or petioles of the leaves, after which they hibernated in plant débris or straw. Up to 80 per cent. of the larvae fail to mature, largely owing to parasitism ; the parasites that have been identified are *Trichomalus fasciatus*, Thoms., *Necremnus duplicatus*, Gah., and species of *Eurytoma*, *Zatropis* and *Amblymerus*. In 1943, the percentage parasitism averaged 35–50 in cabbages, swedes and turnips and ranged up to 72 in cabbages, but in 1944 the average was only 20–40. Practically no parasitism was found in infested radish pods in either season or in infested swede pods in eastern Washington. Since the larvae are not attacked until more than half grown, parasitism is not very effective in reducing seed damage, and the reduction in the numbers of adults does not appear to be sufficient to result in appreciable reduction of seed damage in ensuing seasons. The degree to which different crucifers are attacked is discussed. Larval feeding has been observed only on plants of the genera *Brassica* and *Raphanus*, and *B. campestris* (wild turnip) is considered to be the most important factor in maintaining weevil populations throughout the area of known infestation. Dusts containing pyrethrum, rotenone, calcium arsenate and sodium fluosilicate showed promise against the adults in laboratory tests [*cf.* **33** 24].

During 1943–44, the State Department of Agriculture undertook to eradicate wild vetches, especially along roadsides and stream banks, by spraying with ammonium sulphamate, because they are often infested by the pea moth [*Cydia nigricana*, Steph.] and it is assumed that they are a source of infestation of peas. Investigations are being carried out to determine more accurately the identity of the insects attacking these weeds.

Larvae of *Hylemyia cilicrura*, Rond., killed nearly 20 per cent. of the seedlings of fir [*Abies*] in a forest nursery in July and also attacked spruce seedlings. Chlorpicrin and a mixture of dichlorpropylene and dichlorpropane (DD) applied to the soil as fungicides a few days before the seed was planted on 25th June reduced the percentage of injured plants from 18·4 to 7·5 and from 21·3 to 10·4, respectively. The adult flies emerged in considerable numbers in late July and early August.

DAVIS (A. C.). **The Mushroom Mite (*Tyrophagus lintneri* (Osborn)) as a Pest of cultivated Mushrooms.**—*Tech. Bull. U.S. Dep. Agric.* no. 879, 26 pp., 6 figs., 25 refs. Washington D.C., 1944.

This account of the bionomics and control of *Tyrophagus lintneri*, Osb., one of the most important pests of cultivated mushrooms in the United States and Canada, is based chiefly on investigations carried out in Maryland in 1935–41. The mite feeds on the mycelium and on the caps and stems of the mushrooms ; all stages are described, and differences between the damage caused and that

due to other pests are pointed out. The procedure followed in growing mushrooms is outlined. The temperatures successively used are about 76·5, 65 and 55°F., and the mite was reared at these temperatures in specially devised cells, which are described. The duration of development averaged 12, 19 and 54 days, respectively, and no hypopi were formed; the four immature stages were nearly equal in length, but the larval and protonymphal stages were a little shorter than the egg and deutonymphal stages. The adult life of mites reared in cells lasted 2–209, 10–235 and 3–112 days at the three temperatures, respectively, but mites from a stock culture placed in cells at 55° immediately after the third moult survived as adults for more than five times as long as mites that had been reared in cells. There was little difference in the length of adult life of the two sexes, and the ratio of males to females was 42 : 58. Females mate for the first time almost immediately after the final moult, and some begin to oviposit very soon after, but the preoviposition period usually occupies two or more days, after which oviposition continues for most of the rest of their lives. The eggs are laid singly and in the absence of light. Females reared in cells at 76·5, 65 and 55°F. laid averages of 312, 454 and 16 eggs; five of ten reared at 55° did not oviposit, indicating that this temperature is close to that at which oviposition would cease entirely.

Since *T. lintneri* sometimes attacks cereals, hay, straw and other organic materials, it is probably introduced into the houses in small numbers with compost from infested stables. Preventive measures include the prompt disposal of débris, litter and manure, proper composting, drenching the composting floor with formaldehyde and water (1 : 50) or boiled lime-sulphur and water (1 : 10) before the receipt of new manure and scraping it clean after the compost is transferred to the houses, cleaning the houses while they are empty and spraying them with boiled lime-sulphur in water (1 : 10) about two weeks before filling. Secondary fermentation takes place after the compost is in the house, and the temperature then rises considerably; it should be kept at 130–140° for 7–10 days, to kill any pests present. Electric fans, which are usually operated in the house during the heating period, should be placed so as to drive the air downward to the floor. Opening the houses for a week or more during severe weather is said to kill many pests and to invigorate the spawn.

The fumigants tested included hydrocyanic acid gas [*cf. R.A.E.*, A **24** 141] and sulphur dioxide [*cf.* **23** 470], neither of which can be used when mushrooms are present; nicotine, used as a smudge, which kills few mites and results in the absorption of considerable quantities of nicotine by the mushrooms; paradichlorbenzene, which killed few mites and damaged the mushrooms when applied at the rate of 1 lb. per 1,000 cu. ft. for an exposure of 48 hours; pyridine, which gave excellent results in the laboratory, but had a very objectionable and lasting odour in the houses; methyl bromide, which did not control the mites at a dosage of less than 3 lb. per 1,000 cu. ft., at which it damaged the spawn badly; and formaldehyde, which is of little value against mites and kills the mushrooms. Fumigants do not usually penetrate into the beds far enough to kill mites within the compost. Over 40 materials were tested as dusts or drenches, but few were satisfactory. Tobacco powder (1 per cent. nicotine), mixed with the compost at the rate of 6–10 oz. per bushel before it was put into the house, increased the yield, although in the laboratory mites fed freely on such compost and on that mixed with fixed nicotine. Nicotine preparations applied as dusts had little value against mites, but nicotine sulphate in water (1 : 10 or 1 : 20) was fairly effective in uncased beds. On producing beds, free nicotine in water (1 : 1,500) sprinkled once a week at the rate of 1 U.S. quart per 12 sq. ft. increased yield, although it retarded the growth of the mycelium and did not give a good kill of mites in the laboratory; this treatment cannot be recommended after the beds begin to produce, as the mushrooms take up the nicotine. An alcoholic extract of pyrethrum containing 2 per cent. total pyrethrins, diluted with

water (1 : 800) and applied in the same manner, gave a greater increase in yield, did not damage the spawn, and though it killed relatively few mites, seemed to act as a repellent ; in the laboratory it practically freed spawn of mites within two hours. Dichlorethyl ether and water (1 : 166), emulsified with gum arabic, and methyl salicylate and water (1 : 500) applied in the same way, killed a large proportion of the mites in the beds and did not reduce the crop.

Boiling water applied to beds that have been allowed to dry out somewhat, until the casing soil is well soaked, kills the mites in the top layer of soil without injury to the spawn, and mites on the surface can be killed by means of a blowlamp or live steam applied under pressure.

LAURIE (A.) & KIPLINGER (D. C.). **Culture of Greenhouse Roses.**—*Bull. Ohio agric. Exp. Sta.* no. 654, 94 pp., 40 figs., 24 refs. Wooster, Ohio, 1944.

This bulletin contains a section (pp. 72–76) in which J. S. Houser gives notes on the control of the more important insect and other pests of greenhouse roses in Ohio. The most injurious is *Tetranychus bimaculatus*, Harvey, which can be dislodged by syringing with water ; since this treatment does not remove the eggs, it should be repeated every 7–10 days in winter and twice a week in late spring, summer and early autumn. If the soil is dry it should be watered lightly before syringing and heavily after, to prevent scorching of the foliage. *Heliothrips haemorrhoidalis*, Bch., which feeds on the flower buds and leaves, can be controlled by repeated applications of a spray of nicotine with a suitable spreader, which, however, is not very effective against the adults, or better by a spray of 2 lb. tartar emetic or 2 U.S. quarts sodium antimony lactophenolate, both with 4 lb. brown or white sugar, per 100 U.S. gals. water, applied thoroughly to the upper surface of the foliage 2–3 times a week if the thrips are abundant. If the foliage is very soft, the quantity of sugar should be reduced to 3 lb. The most injurious of the caterpillars that feed on the foliage are *Tortrix* (*Archips*) *rosaceana*, Harr., and *Phlyctaenia rubigalis*, Gn., which can be controlled by hand-picking, by dusts or sprays of pyrethrum or rotenone or by a dust of sulphur and lead arsenate (85 : 15), applied as sparingly as possible. The sprays of tartar emetic or sodium antimony lactophenolate have been recommended for the control of leaf-feeders, but for this they should be applied to both surfaces of the leaves. The Aphid, *Macrosiphum rosae*, L., causes serious damage to the young growth and small buds if it becomes numerous, but is readily controlled by fumigation with hydrocyanic acid gas or nicotine or by spraying with nicotine and a spreader. *Neocerata* (*Dasyneura*) *rhodophaga*, Coq., is most prevalent between May and October ; the larvae feed within the flower buds and among the unfolding leaves and pupate in the soil. Infested plants or plants with soil attached from areas in which this Cecidomyiid occurs should not be brought into the greenhouse. If an infestation develops, any infested plant parts should be removed and destroyed. Fumigating every other night with tobacco destroys many of the adults. The plant beds should be cleared of débris, smoothed and mulched to a depth of ¼–½ in. with tobacco dust (1 per cent. nicotine), which should be replaced if washed away. Spraying the walks and ground beneath the benches with diesel oil kills any larvae that fall from the bench. Strawberries, outdoor roses, blackberries, raspberries and grape-vines should not be grown near rose houses, as *Paria canella*, F., which breeds out of doors on these and other plants, is difficult to control when it invades the houses. If infestation occurs, a combination of measures should be used. Fumigation with hydrocyanic acid gas should be carried out during the drying-off period, and the surface of the soil should be kept free of débris. A mulch of tobacco dust kills many of the newly hatched larvae and a dust or spray of lead arsenate, applied as freely as possible if the spotting of the foliage is not objectionable, kills many of the beetles. Sodium antimony lactophenolate is a satisfactory substitute

for lead arsenate and does not discolour the foliage. Calcium arsenate, distributed over the surface of the soil at the rate of 5 lb. per 1,000 sq. ft., destroys many of the root-feeding larvae. *Pseudococcus citri*, Risso, is not likely to be troublesome unless *Stephanotis*, *Gardenia*, *Poinsettia*, *Coleus* or other susceptible plants are also grown in the houses, and syringing for the control of other pests decreases the risk of damage. Some of the newer insecticides, particularly the thiocyanates, are effective against the mealybug, but may cause leaf-drop or even kill the plants. Evaporating nicotine liquid (¼ oz. per 100 cu. ft.) from heating pipes is also effective. The larvae of the Cephid, *Hartigia* (*Adirus*) *trimaculata*, Say, occasionally bore into the stems and cause them to wilt; the stem should be cut off below the tunnel of the borer and destroyed.

MOTE (D. C.) & OWENS (C. E.). **Insect Pests and Diseases of Currants and Gooseberries.**—*Circ. Ore. agric. Exp. Sta.* no. 152, 11 pp., 3 figs. Corvallis, Ore., 1943.

The first part (pp. 3–7) of this circular is by Mote and contains notes on the appearance, bionomics and control of insects that attack currants and gooseberries in Oregon, of which the principal ones are *Epochra canadensis*, Lw., sawflies, *Capitophorus* (*Myzus*) *ribis*, L., *Aegeria* (*Sesia*) *tipuliformis*, Cl., *Chrysobothris mali*, Horn, and, on gooseberry, *Xylocrius agassizi*, Lec. This Cerambycid probably does not attack currants, but has become so injurious to gooseberry that infested bushes less than six years old often produce only small, inferior fruit and older bushes are killed. Each bush may contain many of these borers. The adults overwinter in the galleries and appear in March and April, when the females oviposit on the crown and canes. The larvae hatch in three weeks, feed in the plants for two summers, passing the intervening winter within their galleries, and pupate in the August of the second year. As there are two broods that complete their development in alternate years, both adults and larvae are present in the bushes each winter. No control measures are known. Cuttings for new plantations should be free from infestation or, where this is not possible, the borers should be carefully removed. Infested bushes in young plantations should be removed and burned, and older plantations that become heavily infested should be destroyed during the winter.

EBELING (W.). **Summary of Field Experiments with DDT and Rotenone used in Red Scale Control.**—*Calif. Citrogr.* **30** no. 6 pp. 164, 193, 1 fig., 1 ref. Los Angeles, Calif., 1945.

Laboratory work having shown little increase in the immediate toxicity of spray oils to the red scale [*Aonidiella aurantii*, Mask.] when DDT was added, but an improvement in the eventual effect because the DDT residues left by the spray inhibited the settlement of crawlers and interfered with the normal development of those that did settle [*cf. R.A.E.*, A **33** 113], experiments on the control of the scale with DDT and rotenone were carried out in orange and lemon orchards in California. The numbers of adult female scales on samples of leaves, twigs or fruit were counted before treatment and 3–14 months after. The addition of 4 gm. DDT per 100 ml. light-medium spray oil increased the effectiveness of the oil in experiments made during spring and summer, though only two of five treatments applied during November 1943 showed a marked improvement in control. A spray of 3 per cent. kerosene containing 4 per cent. DDT was less effective than 1¾ per cent. light-medium or heavy-medium spray oil, but spraying twice a year or increasing the amount of DDT in the kerosene by means of solvents gave promising results; this is particularly important as kerosene does not accentuate water spot of navel oranges as the regular oil

spray does [*cf.* **20** 569 ; **25** 38]. Gesarol AK-20, a proprietary powder containing 20 per cent. DDT, applied in a spray at 10 lb. per 100 U.S. gals. water, without oil, was less effective than 1¾ per cent. light- or heavy-medium oil, even in double applications, and a 5 per cent. DDT dust applied once in July and once in August at the rate of 1½ lb. per tree gave no control of the scale. In all orchards in which DDT was used there was an increase in the population of the citrus red mite [*Paratetranychus citri*, McG.], and in one orchard Aphids also became a serious pest ; neither of these was of commercial importance in plots in which only oil was used. The increase in the number of mites was greatest where DDT was used with kerosene, in an aqueous suspension of powdered solids or as a dust. No plant injury was found on trees treated with DDT.

Variable results were obtained with rotenone compounds. In a lemon orchard in San Fernando, annual applications of 1¾ per cent. light-medium oil with 1 U.S. quart of 5 per cent. derris extractives in *n*-butyl phthalate per 100 U.S. gals. spray gave as good control as 1¾ per cent. heavy-medium oil over a three-year period, and in other tests the addition of 1 lb. cubé root (5 per cent. rotenone) to 1¾ U.S. gals. oil used at 1¾ per cent. resulted in a greater reduction in population a year after treatment than did the same concentration of oil alone, but in some experiments the addition of cubé had no residual effect, although it caused a considerably higher kill when the sprays were applied. In comparison with the number of scales on trees sprayed with the oils alone, the use of 0·62 per cent. derris extractives in 1·8 per cent. heavy-medium oil reduced the scale population 12½ months after treatment by 50 per cent., and cubé, though somewhat less effective, also increased the residual effect of the oil, but in another test the population was 60 and 65 per cent. greater 11 months after treatment where derris extractives and cubé, respectively, were added to 1·8 per cent. light-medium emulsive oil.

When cubé root was added to a spray of kerosene and DDT, it decreased the residual effectiveness of the spray in five out of six tests [*cf.* **33** 113]. This cannot have been due to the effect of cubé on the relatively unimportant predators and parasites of the scale, as DDT appears to affect them even more.

These experiments show that derris extractives and cubé root used in oil at concentrations known to increase the immediate kill of the scale do not necessarily improve the control after it has passed through one or more generations. Higher concentrations of derris extractives were not tested, because the mutual solvent (*n*-butyl phthalate) caused increased defoliation of orange trees when used in the amounts necessary for incorporating them in the oil, but Cressman and Broadbent [**33** 342] found that the long-term effectiveness of oils was constantly increased by the addition of 1·1–1·2 per cent. derris extractives.

De Saeger (H.). **Note sur le genre** *Fornicia*, **Brullé. Un Chelonide (Hym. Bracon.) nouveau du Congo belge.**—*Rev. Zool. Bot. afr.* **34** fasc. 2 pp. 144–148, 2 figs. Brussels, 1941.

Lists are given of the 13 hitherto described species of the Braconid genus *Fornicia* and the hosts of the five of which they are known. All the recorded hosts are Limacodids. *F. ghesquièrei*, sp. n., is described from males reared from the Limacodid, *Phorma pepon*, Karsch, on coffee in the Belgian Congo.

De Saeger (H.). **Le genre** *Apanteles* **au Congo belge (Hym. Braconidae). Contribution à l'étude du genre.**—*Rev. Zool. Bot. afr.* **34** fasc. 3–4 pp. 322–347 ; **35** fasc. 2 pp. 218–268, 26 figs. Brussels, 1941.

The many new species described include *A. congoensis* reared from *Dichocrocis crocodora*, Meyr., on coffee, *A. uroxys* from flowers of *Coelocaryon staneri*,

together with *Myelois ceratoniae*, Zell., *A. ghesquièrei*, from *Eublemma* sp. and *E. costimacula*, Saalm., predacious on Coccids, *A. bredoi* from *Sylepta derogata*, F., on cotton, *A. wilkinsoni* from *Lamprosema indicata*, F., on cowpeas, and *A. epiplemicidus* from *Leucoplema* (*Epiplema*) *dohertyi*, Warren, on coffee. *A. congoensis* is described in the first part of the paper, and the others in the second.

GHESQUIÈRE (J.). **Contribution à l'étude des Hyménoptères du Congo belge. VIII.—Sur deux Chalcidiens Encyrtidae nouveaux pour la faune congolaise.** —*Rev. Zool. Bot. afr.* **35** fasc. 1 pp. 133–135, 10 refs. Brussels, 1941.

The Encyrtids, *Anicetus parvus*, Comp., and *Bothriophryne ceroplastae*, Comp., have been reared in considerable numbers from *Ceroplastes quadrilineatus*, Newst., on *Annona muricata* in Kivu, and occasional examples of *B. ceroplastae* have been observed there on coffee infested by *C. destructor*, Newst. The two Coccids, as well as the parasites, had not previously been recorded from the Belgian Congo.

DE SAEGER (H.). **Le genre *Microgaster* au Congo belge (Hym. Braconidae).**—*Rev. Zool. Bot. afr.* **35** fasc. 3–4 pp. 332–341, 4 figs. Brussels, 1942.

Seven species of *Microgaster* are recorded from the Belgian Congo, of which two are described as new. One of the latter is *M. sylleptae*, reared from *Sylepta sabinusalis*, Wlk., on *Boehmeria nivea*. A list of all the Ethiopian species is appended, showing their distribution and, where known, their hosts and the food-plants of the latter.

SCHOUTEDEN (H.). **Le genre *Lycidocoris* Reut. et Popp. (Hem. Miridae).**—*Rev. Zool. Bot. afr.* **36** fasc. 1 pp. 1–4. ***Yangambia* nov. Gen. Miridarum (Hem. Miridae).**—*T.c.* pp. 5–7. Brussels, 1942. **Notes sur quelques Bryocorines d'Afrique (Hem.).**—*Op. cit.* **39** fasc. 1 pp. 115–117. Brussels, 1945.

In the first paper *Ealincola*, gen. n., is erected for *Lycidocoris modestus*, Dist. (the type) and *L. thoracicus*, Dist. In the second, *Yangambia vesiculata*, gen. et sp. n., is described from the Belgian Congo. In the third, comments are made on W. E. China's work on West African Bryocorines [*R.A.E.*, A **32** 419], with records of some of the species from the Belgian Congo. It is pointed out that the genotypes of *Yangambia* and *Idioaspis*, China (*macarangae*, China) are identical, so that the latter is a synonym of the former, and that *L. modestus* and *L. thoracicus*, the two species referred by China with some doubt to *Pantilioforma*, are those for which *Ealincola* was erected.

DE SAEGER (H.). **Espèces nouvelles et notes sur quelques Chelonides (Hym. Braconidae) du Congo belge.**—*Rev. Zool. Bot. afr.* **36** fasc. 1 pp. 8–15, 3 figs. Brussels, 1942.

The new species described include *Phanerotoma ornatulopsis* reared from *Earias biplaga*, Wlk., on cotton, and *P. phycitinoma* from *Cryptoblabes gnidiella*, Mill., predacious on *Stictococcus* sp.

DE SAEGER (H.). **Quelques Braconides nouveaux du genre *Microbracon*.**—*Rev. Zool. Bot. afr.* **36** fasc. 4 pp. 361–389, 3 figs. Brussels, 1943.

Among the new species described are *Bracon* (*Microbracon*) *etiellae* reared from *Etiella zinckenella*, Tr., on *Tephrosia vogeli* and *Crotalaria juncea*, and *B.* (*M.*) *terastiae* from *Terastia meticulosalis*, Gn., on *Erythrina abyssinica*, both in the Belgian Congo. The author has found that the parasite of *Sylepta*

derogata, F., on cotton in Tanganyika recorded as *B.* (*M.*) *recessus*, Szépl. [*R.A.E.*, A **17** 483; **25** 50] was misidentified and is *B.* (*M.*) *bipustulatus*, Szépl., which is also recorded from an unknown host in Natal, and from *S. derogata* on *Hibiscus esculentus* in the Belgian Congo.

GHESQUIÈRE (J.). **Recherches sur les Diptères d'Afrique. II.—Notice monographique sur les Muscoïdes Cryptochaetidae, parasites de Coccides Monophlebinae.**— *Rev. Zool. Bot. afr.* **36** fasc. 4 pp. 390–410, 8 figs., 19 refs. Brussels, 1943.

Icerya (*Pericerya*) *purchasi*, Mask., has on several occasions been imported into the Belgian Congo on *Citrus* stock and has been found on *Citrus* and other plants in a few localities there [*cf.* also *R.A.E.*, A **33** 365]. On one occasion it was intercepted on *Citrus* also infested by *Lepidosaphes* (*Mytilococcus*) *beckii*, Newm., which occurs in the Colony, and *L.* (*M.*) *gloverii*, Pack., which has not been recorded in any part of tropical Africa except Uganda. In view of the risk of its increase and spread, a survey was made to determine whether any parasite likely to be of value against it existed in the Belgian Congo. During the course of this, *Cryptochetum iceryae*, Will., its principal parasite, was reared from other Coccids, together with *C. curtipenne*, Knab, hitherto known only from Ceylon [**2** 307, 652] and two new species, *C. melanum* and *C. aspidoprocti*, which are described and for which the new subgenus *Tritolestes* is erected.

The distribution of *C. iceryae* in other countries is reviewed. It is widely distributed in the Belgian Congo and was found at an altitude of over 6,000 ft., though it was more common at lower altitudes in the central forest region. The hosts from which it was reared were *Crypticerya natalensis*, Dgl., which is common on rose, *Icerya nigroareolata*, Newst., on coffee and *Alchornea cordifolia*, three other species of *Icerya* on orange and *Tephrosia* grown as shade for coffee, and *Pseudaspidoproctus vayssieriellus*, sp. n., which is described in a footnote and which attacks oil palm (*Elaeis guineënsis*) and is becoming established on other palm trees, notably *Oreodoxa regia*, in the Botanical Gardens at Eala. The adult parasites are active by day and at dusk settle on the lower surface of the leaves, where they feed on honey-dew secreted by the Coccids. They cannot be reared in small cages, but they survived for a week and the females oviposited when kept in cages 2 cu. m. in volume and fed on fruit juice. The eggs are laid in the Coccid host, within which the complete development takes place; generally only one parasite emerged from each host [*cf.* **19** 698]. The development cycle lasted about a month. *C. iceryae* was parasitised in the Belgian Congo by a species of *Pachyneuron*, and a tertiary parasite, *Allotropa* sp., was also present. In Australia, it is attacked by *Euryischia lestophoni*, Ril., which has also been recorded as a parasite of *Crypticerya rosae*, Ril. & How., on *Grevillea* at Sydney. Record of natural enemies of other species of *Cryptochetum* in various countries are briefly reviewed.

C. melanum, *C. aspidoprocti* and *C. curtipenne* were found only in or near the Botanical Gardens at Eala (western Congo). *C. melanum* parasitised *I. tremae*, Vayss., which was common on cultivated *Artocarpus*, and two undetermined species of *Icerya*, one of which attacks *Entada gigas* and the other occurs on the lower surface of leaves of orange. It resembled *C. iceryae* in adult habits and duration of development; hosts are most frequently attacked in the second instar, and the parasite larvae are generally solitary. *C. aspidoprocti* was reared only from *Aspidoproctus congolensis*, Vayss., which occurs on marsh copal (*Copaifera demeusei*), and is becoming adapted to several other leguminous plants in the Botanical Gardens, where its progress is considerably checked by the parasite. Four adults of the latter were obtained from a single third-instar host, and 88 from 58 hosts in the second and third instars. *C. curtipenne*, which appears to be rare, was reared only from *Pseudaspidoproctus vayssieriellus* on *Elaeis*.

A catalogue of the species of *Cryptochetum* is given, showing their hosts and distribution, with records of their parasites and other biological data in some cases. This is followed by a key to the subgenera and species.

GHESQUIÈRE (J.). **A propos de quelques Galleriadae palmicoles éthiopiens et orientaux.**—*Rev. Zool. Bot. afr.* **37** fasc. 1–2 pp. 97–101. Brussels, 1943.

Descriptions are given of the adults of both sexes of *Chevalierella elaeidis*, gen. et sp. n., and *Epimorius adustalis*, Hmps. (of which *Eloeidiphilos aliberti*, Praviel [*R.A.E.*, A **27** 349] is considered a synonym) from the Belgian Congo, where the larvae of both infest the inflorescences of oil palms (*Elaeis guineënsis*). *Tirathaba trichogramma*, Meyr., is transferred to the genus *Coleoneura*.

RAUCOURT (M.). **La détermination des doses toxiques de certains produits envers le doryphore.**—*Ann. Epiphyt. Phytogén.* **7** fasc. 2 pp. 129–133, 1 fig., 3 refs. Paris, 1942.

The author describes a laboratory method for testing stomach poisons for the control of *Leptinotarsa decemlineata*, Say, that has given very accurate results for products with no contact or repellent action, such as insoluble arsenicals. It consists in cutting disks from leaves of potato bearing a uniform spray deposit, analysing the amount of insecticide on some of them and allowing larvae to feed singly on the others for a short time, usually 10 or 15 minutes, estimating the amount of insecticide ingested by each larva from the area of disk it has consumed, and recording the mortality percentages among groups of larvae that have ingested approximately equal quantities.

CHAPPELLIER (A.) & RAUCOURT (M.). **Les rapports entre les traitements arsenicaux antidoryphoriques et le gibier.**—*Ann. Epiphyt. Phytogén.* **8** fasc. 1 pp. 1–39, 3 pls., 11 figs., 5 refs. Paris, 1942.

An account is given of investigations carried out in France in 1935–39 from which it is concluded that there is little danger of the arsenical treatment used against *Leptinotarsa decemlineata*, Say, on potato resulting in the poisoning of game [*cf. R.A.E.*, A **24** 756]. Of many dead birds examined, small numbers of poultry from the vicinity of treated fields had been poisoned, but no mortality due to arsenic was observed in young or adult pheasants and partridges in such neighbourhoods ; the birds did not feed on the beetles. It was found that rain did not collect dangerous quantities of arsenic from sprayed or dusted plants, the maximum quantity in water dripping or trickling from them being 1 mg. arsenic (As) per litre.

GUÉRIN (H.) & RAUCOURT (M.). **Sur quelques propriétés des arséniates de calcium en relation avec leur utilisation en phytopharmacie.**—*Chim. et Industr.* **47** no. 6 pp. 597–602, 1 graph, 17 refs. Paris, 1942.

RAUCOURT (M.), GUÉRIN (H.), BÉGUÉ (H.) & MOREL (G.). **L'action insecticide des arséniates de chaux contre le doryphore.**—*Ann. Epiphyt. Phytogén.* **9** pp. 1–9, 3 figs., 5 refs. Paris, 1943.

These papers contain accounts of experiments in which various calcium arsenates and strontium and barium orthoarsenates were tested in the laboratory and applied as sprays in the field for the control of *Leptinotarsa decemlineata*, Say, on potato in France. The results have already been noticed [*R.A.E.*, A **30** 466]. The first paper also includes details of the effect of the compounds on plants and the precautions necessary when they are used on plants, such as apple, that are particularly susceptible to injury from soluble arsenicals, and the second, in which the insecticidal tests are given in more detail, includes

an account of additional tests with 46 samples of commercial calcium arsenates (chiefly the tricalcium and tetracalcium salts), which confirmed the results obtained with the pure compounds. Aqueous suspensions of the compounds had no observed effect on such resistant plants as potato, the scorching sometimes caused by insecticides containing them being evidently due to defective preparation.

RAUCOURT (M.) & BÉGUÉ (H.). **Etude sur les produits utilisés en France contre le doryphore.**—*Monogr. Sta. Lab. Rech. agron.* 115 pp., 4 pls., 34 figs., many refs. Paris, 1942. Price *Fr.* 45.

The authors summarise the results of laboratory and field tests in 1931–40 of various experimental compounds and of proprietary products recommended against *Leptinotarsa decemlineata*, Say, on potato in France [*cf. R.A.E.*, A **27** 675], from which they conclude that arsenicals and rotenone powders are the most effective. The arsenicals are the most useful, as those that control the larvae are more effective than other materials against the feeding adults, and also have a prolonged residual effect. Lead arsenates should be applied in sprays at rates per acre equivalent to about 90 gals. spray and 1–1·6 lb. arsenic (As) and may be effective for 15–20 days when the highest dosage is used. Dusting with lead arsenate, which is not officially authorised, requires similar quantities of arsenic. The most active forms of lead arsenate are powders containing 18–20 per cent. arsenic, pastes containing 15–16 per cent. and nascent lead arsenate ; the last is prepared from a mixture of anhydrous sodium arsenate and lead acetate (1 : 3), which precipitates triplumbic lead arsenate when mixed with water. Calcium arsenates are more effective than lead arsenates. Tricalcium arsenate in the form of powders containing 22–26 per cent. arsenic is applied in sprays at the same rate as lead arsenate, but the quantity of arsenic may be reduced to 0·45 lb. per acre for very active compounds. Calcium arsenate is the only arsenical authorised for use as a dust, and the quantities officially recommended are 13·5–22·5 lb. per acre of a product containing 9·6–13·5 per cent. arsenic. Paris green appears to be more effective in dusts than, as authorised, in sprays. It is usually applied at lower dosages of arsenic than lead arsenate, and its action on the larvae is more rapid. Neutral and basic copper arsenates and copper arsenite are rarely used but are very effective, the arsenates are equal to lead arsenates and the arsenite almost equal to Paris green. Powders and pastes of aluminium arsenate gave variable results and were often ineffective, but nascent aluminium arsenate (prepared from a mixture containing 32 per cent. disodium arsenate and 30 per cent. aluminium sulphate) was as effective as nascent lead arsenate. Naturally occurring minerals containing arsenic and arsenical residues of metallurgical processes gave very poor control or none at all.

Dusts containing rotenone are more effective than arsenicals against the larvae and act more rapidly, but are ineffective against the adults and have no residual action. Derris, cubé or timbo mixed with inert dusts gave practically complete control of the larvae when used at rates that applied 1·2 oz. rotenone per acre, and derris and cubé sprays gave similar results provided that 1½ oz. rotenone per acre was applied ; the dusts were not improved by the addition of 10 per cent. barium fluosilicate. The rotenone products now in use retain their insecticidal properties for some years in storage.

Fluorine compounds are satisfactory substitutes for arsenicals and rotenone, but are usually less effective. Barium fluoride acts as both contact and stomach poison. It is applied in inert dusts (20 : 80) at the rate of at least 7·2 lb. barium fluoride per acre. Its effectiveness depends on its physical properties and on the temperature ; it is sometimes more rapid in action against the larvae than lead arsenate, and it has a residual effect intermediate between those of rotenone and arsenicals. Sprays of 20 lb. cryolite per 100 gals. gave similar results when

applied at about 16 lb. sodium fluoaluminate per acre. Calcium cyanamide, which is a powerful contact poison for the larvae, is also injurious to the plants, but can safely be applied as a 25 per cent. dust at the rate of not more than 27 lb. of the mixture per acre. Nicotine treatments gave good results in the laboratory but not in the fields; neither nicotine alkaloid nor nicotine sulphate is very effective against *L. decemlineata*.

Of the compounds tested, only copper salts showed a strong repellent action towards the larvae and adults; a spray of copper oxychloride, applied at the rate of about 6 lb. copper per acre at the beginning of the outbreak, reduced infestation by 66 per cent. None of the products tested, except possibly nicotine, had any ovicidal effect, but they were more effective against young larvae than against older ones.

HURST (H.). **Principles of insecticidal Action as a Guide to Drug Reactivity-Phase Distribution Relationships.**—*Trans. Faraday Soc.* **39** pt. 12 pp. 390–411, 1 fig., 46 refs. London, 1943.

The author shows that all the components of a drug mixture applied to a biological system may contribute towards the gross biological activity set up, and discusses the factors that influence the intensity of the latter when diffusion through an intermediary biophase or membrane intervenes with reference to investigations conducted with insects, chiefly blowfly larvae, and the first eight members of the homologous series of primary alcohols and fatty acids, the homologous members of which differ only in the polar portions of the molecules. Some of the results have already been noticed [*R.A.E.*, A **29** 239]. Comparative studies in which the larvae were immersed in the undiluted drugs, or aqueous solutions of the latter were injected into the haemolymph, showed that relative biological activity at the site of application may differ from that at the site of action, and that drug reactivity may increase, remain constant or decrease, as the homologous series is ascended, according to the site and method of application. In the immersion tests, the toxicities of the fatty acids and alcohols decreased and increased, respectively, up to the fifth homologue and then converged; this cannot be attributed solely to simple distributions of the drugs between immiscible phases brought about by adsorption or differential solubility, and shows the influence of both polar and non-polar portions of the drug molecules.

Evidence is given that the surface of the cuticle of a blowfly larva consists of heterogeneous patches of lipoid and protein; the layer below the epicuticle consists of a chitin framework closely associated with protein components, which are relatively water-soluble. The bulk cuticle phase is permeated by a fatty secretion from the epidermal cells, which passes to the epicuticle along specialised ducts. The increase in drug penetration through living and dead cuticle, particularly through the epicuticle, brought about by the presence of fat solvents [**29** 240] is reversible, but prolonged immersion in fat solvents causes an irreversible increase, after which the use of oil carriers induces a still greater increase. From this it is concluded that only part of the lipoid components are removed by the fat solvents, and that drug penetration cannot depend primarily on solubility in lipoids. Carrier activity is influenced markedly by the physical nature of the oil carrier employed, but not by its toxicity, and is most intense in the outer layer of the cuticle. It is attributed to an increase in the free volume of the lipoid phase brought about by non-polar interaction between fat-solvent molecules and cuticle lipoids causing a reduction in the cohesion between the lipophilic elements and possibly to the linking of separate patches of lipoid, with which may be associated changes in the orientation of the protein molecules, and to a secondary irreversible action involving the rupture of the labile bonding elements of the lipophilic chains, which permits increased mobility of water molecules. The latter reaction would account for

the increase in permeability to drugs such as fat-soluble alcohols when some cuticular lipoids have been removed by prolonged exposure to fat solvents. Further support for the suggestion that the labile cuticle components regulate cohesion is provided by the action of inert dusts, which cause irreversible secondary changes in the epicuticular framework when the rate at which they adsorb lipoids exceeds that at which the latter are replaced [**34** 60]. It is shown that a drug may induce its own penetration through the cuticle or exert a carrier action when forming part of a mixed drug system. When alcohols are included in mixed systems, their carrier activity increases and then decreases as the series is ascended and capillary activity becomes more marked ; carrier activity is less marked in the acids and becomes pronounced at a later stage in the series.

The cuticular framework is analogous to a composite visco-elastic system of liquid/liquid interfaces between the protein and lipoid phases ; both phases are hydrophilic, and the latter possesses high functional viscosity. The experimental evidence supports the view that drug penetration through the cuticle is by means of two-dimensional diffusion along the functional interfaces, limited by polar interaction between the drug molecules and the protein components, non-polar action between the hydrocarbon chains and the lipoid components, and the interfacial viscosity. When substances of high capillary activity are present in the drug system selective adsorption at the interface renders it less accessible to other components of lower capillary activity. Three-dimensional diffusion through the bulk lipoid and protein phases may also occur and probably predominates in non-capillary active systems. The diverging toxicity to blowfly larvae shown by the ascending series of alcohols and fatty acid homologues is attributed to differences in the intensity of the polar and non-polar molecular interactions. Non-polar solvents are believed to induce penetration by decreasing the functional viscosity of the lipoid phase, and where polar carriers of moderate capillary activity are involved, the increased mobility of the drug due to dispersant action on the lipoid phase is of greater importance than the opposing influence of carrier adsorption at the interface.

The results obtained by injecting solutions of the drugs into the haemolymph are also explained by molecular interaction, on the assumption that the primary interaction takes place at specific lipoid or protein loci, and that the interaction at specific enzyme centres embedded in the lipo-protein association occurs secondarily. It is shown, however, that the influence of a diffusion factor is dominant, and that, where differences in drug access are limiting factors, the relative biological activities of a range of drugs may differ considerably in experiments with different biological systems.

In the presence of a drug of low molecular activity, water has a negligible carrier activity, and a mixture of the two is relatively non-toxic to blow-fly larvae at all concentrations, but when pyrethrins, the molecular activity of which is extremely high, are also present, the concentration of pyrethrins required to induce the primary symptoms of narcosis decreases as the proportion of water in the mixture increases. This is attributed to the establishment on the cuticular surface of scattered functional lipoid/water interfaces, at which adsorption of pyrethrins takes place ; the increase in the concentration presented to the insect at this two-dimensional interface is greater than the corresponding decrease in concentration in the bulk drug solution owing to the diluent action of the water. The activity of pyrethrins applied as an external two-dimensional system was shown by an experiment in which insects were immersed in water containing pyrethrins or suspended at the air/water interface at which the pyrethrins were adsorbed. The effect of the pyrethrins was negligible in the bulk aqueous phase, but similar in the two-dimensional film to that obtained when they were applied as a three-dimensional phase in an organic solvent.

The author concludes that the active concentration of capillary active drugs in an aqueous carrier does not necessarily indicate the active concentration at the interface between the carrier and the biological system, owing to the possibility of selective adsorption at the functional lipoid/water interfaces induced by contact of the carrier with the biological system, and that adsorption at biophases may limit the reactions of drugs wherever an aqueous phase participates functionally or is introduced into a biological system. He discusses these principles with reference to other lipo-protein associations in animals and plants, to all of which they are applicable, and states that penetration is facilitated most by non-polar fat solvents, cyclic hydrocarbons such as cyclohexane, and relatively simple solvents such as carbon bisulphide, less by saturated aromatic compounds, and least by unsaturated aromatic compounds, the decrease in effectiveness being associated with progressive increase, in the order given, of capillary activity [*cf.* **30** 513].

Webb (J. E.) & Green (R. A.). **On the Penetration of Insecticides through the Insect Cuticle.**—*J. exp. Biol.* **22** no. 1–2 pp. 8–20, 2 figs., 9 refs. London, 1945.

The following is largely the authors' summary. Experiments with *Melophagus ovinus*, L., as test insect showed that certain organic solvents of diphenylamine, such as the cresols, benzyl alcohol and 4-methyl-cyclohexanol, greatly increase the speed of action of this insecticide. Others, such as methyl benzoate and carbitol [diethylene glycol monoethyl ether], gave little or no improvement in the time of kill. The degree to which a solvent induces rapid penetration of an insecticide is referred to as its " carrier efficiency ". The influence of the physical properties of the solvents on carrier efficiency could be correlated with a high rate of penetration through beeswax, a high partition coefficient of the solvent between beeswax and water (calculated by dividing the concentration in water by that in beeswax), and a high solubility of insecticide in a solution of the solvent in water. The volatility of the solvent and the solubility of the insecticide in it were also contributory factors. Mixtures of two solvents, each showing no carrier efficiency, but together possessing all the essential physical properties, showed a carrier efficiency considerably higher than that of either constituent. This is taken as supporting evidence that carrier efficiency depends on certain physical properties of a solvent. A range of solvents shown to exhibit various degrees of carrier efficiency with diphenylamine gave comparable results with dixanthogen, ω-nitrostyrene dibromide and rotenone, showing that the synergy could be extended to other insecticides.

It is suggested that certain solvents increase the rate of penetration of contact insecticides through the insect cuticle in the following ways : by transporting the insecticide through the lipoid elements of the epicuticle [*R.A.E.*, A **34** 60, 61] to the interface between this layer and the water permeating the exocuticle ; by concentrating the insecticide at the interface between the epicuticle and the exocuticle, as the solvent passes into the exocuticle, and thus increasing the diffusion gradient of the insecticide across that interface ; and by increasing the solubility of the insecticide in the water permeating exo- and endo-cuticles and thus, by raising its partition coefficient between solvent in the epicuticle and water in the exocuticle, further increasing its rate of diffusion, not only across this interface, but also through exo- and endo-cuticles to the hypodermis.

Besemer (A. F. H.). **Biologie van de dennenbladwesp (*Diprion pini* L.).** [The Biology of the Pine Sawfly, *D. pini*.]—*Tijdschr. PlZiekt.* **48** no. 6 pp. 213–217. Wageningen, 1942.

An outbreak of *Diprion pini*, L., on pine occurred in 1938–41 in a national park in central Holland. It began towards the south of the area and gradually

moved to the north and north-west, against the prevailing winds. The sawfly has two generations a year, the adults emerging at the end of April and at the end of July or beginning of August. The males are attracted to the females by scent, and females that are not fertilised soon after emergence give rise to male progeny only. The sex ratio is thus dependent on the weather, since few females are fertilised in bad weather; the percentage of males in population samples varied from 10 to 40.

In 1938, infestation was restricted to certain comparatively small parts of the affected area. These had rather poor soil and scanty vegetation and constituted the foci from which the infestation subsequently spread. The fact that the sawfly can maintain itself more or less permanently in these foci is attributed to the ineffectiveness in them of natural enemies. The chief predators present were the mice, *Apodemus sylvaticus* and *Evotomys glareolus*, which destroy the cocoons, and certain forest forms of *Formica rufa*, L., which are predacious on the larvae. These ants were not present in the permanent foci, and the runways of the mice were restricted to the litter immediately beneath the trees. They did not attack cocoons in moss or grass. Outside these areas, where there was more undergrowth, the ants were common and the mice destroyed almost all the cocoons in the litter. Little additional control was given by parasites of the larvae and cocoons, but *Achrysocharella ruforum*, Krausse, which parasitises the eggs, soon became numerous. This Eulophid was not common in the spring of 1939, but later in that year it parasitised about 50 per cent. of the eggs in the centre and 12 per cent. at the edges of the foci. In the summer of 1940 almost all the eggs were parasitised and the outbreak collapsed. Further north, the percentage parasitism was still only 20–50 per cent., but almost all the eggs were parasitised in 1941. Like its host, *Achrysocharella* has two generations a year, the adults emerging in April–May and July. It is restricted to Diprionines and is reduced to very small numbers with the decline in the population of its host.

FRANSEN (J. J.). **De bestrijding van de dennenbladwesp (*Diprion pini* L.) in Nederland.** [The Control of the Pine Sawfly, *D. pini*, in Holland.]—*Tijdschr. PlZiekt.* **48** no. 6 pp. 217–225, 20 refs. Wageningen, 1942.

Following a review of early recommendations for the control of *Diprion pini*, L., on pine in Holland, the author gives an account, based partly on the literature, of work there on the control of this sawfly by means of insecticides [*cf. R.A.E.*, A **26** 348; **28** 500]. Dusts of derris and pyrethrum were first used in 1935–36 with fair success, but appeared to be uneconomical, and the cost was not sufficiently reduced by applying them only to the edges of pine stands, where infestation is heaviest.

Further work was carried out in 1938–40 in a national park in central Holland [*cf.* preceding abstract], when it was found that derris powder, which killed the larvae comparatively slowly, permitted more of their parasites to complete development than pyrethrum, which killed them quickly. Dew or rain shortly before an application increased its effectiveness, and a given amount of dust was more effective when applied in two lots than when applied all at once. Laboratory experiments on the concentrations required to kill half- to full-grown larvae showed that when applied at a rate equivalent to 30 lb. per acre, pyrethrum dusts containing 0·45 per cent. pyrethrins were effective, but not those containing 0·15 per cent. This rate was unnecessarily high for a derris dust containing 0·75 per cent. rotenone. Young larvae were more susceptible than older ones, and complete mortality of larvae about 1·5 cm. in length was given in one day in the laboratory by a dust containing 0·025 per cent. pyrethrins applied at a rate equivalent to 45 lb. per acre, and 50 per cent. by one containing 0·0125 per cent. A derris dust at the same rate gave complete mortality when

the rotenone content was 0·125 per cent. and nearly 80 per cent. when it was half as much. In both field and laboratory tests, larvae paralysed by derris sometimes recovered, but this did not occur with pyrethrum. Dusts containing both derris and a small amount of pyrethrum were therefore considered promising, and experiments were carried out to find a good carrier. Of the various substances tested, the most promising were dolomite and gypsum. Dolomite is alkaline in reaction, and it reduced the toxicity of some derris powders. The tests also showed that calcium cyanamide, which is a possible carrier, was itself toxic to the larvae. In field experiments in 1938, good results were given by mixed dusts containing 0·00625 per cent. pyrethrins and 0·25, 0·125 or 0·0625 per cent. rotenone in gypsum or dolomite, and a dust of 0·00625 per cent. pyrethrins in calcium cyanamide was effective against the full-fed larvae. In a comparative test, good mortality of larvae nearly or quite full-grown was given by dusts containing 0·00625 per cent. pyrethrins and 0·25–0·0625 per cent. rotenone, calcium cyanamide alone and 0·00625 per cent. pyrethrins in 50 per cent. cyanamide, but not with this content of pyrethrins in 25 or 12·5 per cent. cyanamide, largely owing to unfavourable weather. The mixture containing 25 per cent. cyanamide later gave almost complete mortality in sunny weather, but that containing only 12·5 per cent. was still unsatisfactory.

Tests in 1939 showed that the mixtures of derris and pyrethrum in dolomite or gypsum had not lost any of their effectiveness on storage, but the pyrethrum in calcium cyanamide had lost most of its toxicity and few larvae fell from trees dusted with it unless they were previously wetted. In one case, the dusts were successfully applied from an aeroplane, but ground apparatus was again used in 1940.

FREY (W.). **Versuche zur Bekämpfung der Kohlwanze** (*Eurydema oleraceum* **L.) mit chemischen Mitteln.** [Experiments on the Control of *E. oleraceum* by chemical Means.]—*Arb. phys. angew. Ent. Berl.* **9** no. 2 pp. 77–89. 1942. (Abstr. in *Tijdschr. PlZiekt.* **49** no. 1 pp. 33–34. Wageningen, 1943.)

Eurydema oleraceum, L., was very injurious to swedes in various parts of Germany in 1940 and 1941, and experiments were begun in the latter year on sprays and dusts for its control. A spray of 2 per cent. lysol was ineffective against the adults, and one of 4 per cent., though better, was still insufficient, though it killed all the nymphs in four hours. There was some risk of its scorching young plants. A spray of 2 per cent. petroleum oil and 5 per cent. soft soap was also ineffective against the adults, but an increase in the oil content to 5 per cent. gave good results. Replacing the soap with a spreader or soap substitute reduced toxicity. Both the sprays with soap were effective against the nymphs and only slightly scorched the plants. Crude oil and soap was as effective as the petroleum-oil spray, and toxicity was not decreased by the use of a spreader instead of soap, though soap substitute was again ineffective. Only slight scorching occurred. Derris dusts, even those containing as much as 3 per cent. rotenone applied at a rate equivalent to 45 lb. per acre, did not give more than 29 per cent. mortality after one day, and sprays and dusts of pyrethrum and commercial mixtures of derris and pyrethrum were completely ineffective. A proprietary dust containing dinitro-o-cresol gave complete mortality in 4 hours at a rate of 9 lb. per acre, but caused severe scorching. It also gave good mortality when diluted with talc (1 : 5) and applied at twice the rate, but it still scorched the plants, and was ineffective when diluted to 1 : 8. Nicotine sprays were ineffective against the adults, and sprays of quassia were useless. As soap was almost unobtainable, the spray of crude oil with a spreader was recommended, though lysol and dusts containing dinitro-o-cresol may be used in case of need.

KRONENBERG (H. G.). **Virusziekten in aardbeien.** [Virus Diseases in Strawberries.]—*Tijdschr. PlZiekt.* **49** no. 2 pp. 74–76. Wageningen, 1943.

In this paper, which is a summary of a public lecture, the author briefly reviews the literature on the yellows or yellow edge, crinkle and witches' broom diseases of cultivated strawberries [*Marmor marginans*, *M. fragariae* and *Nanus fragariae* of Holmes], all of which are transmitted by the Aphid, *Capitophorus fragariae*, Theo., and states that symptoms resembling those of yellows and typical symptoms of the other two diseases have been observed in strawberries in various parts of Holland.

MEYERS (P. G.). **Waarnemingen omtrent het optreden van erwtenbladrollers.** [Observations on the Occurrence of Pea Tortricids.]—*Tijdschr. PlZiekt.* **49** no. 3 pp. 111–112. Wageningen, 1943.

Peas grown on the sandy-loam and clay soils of Groningen, in Holland, are infested to an increasingly great extent by larvae, chiefly those of *Cydia* (*Grapholitha*) sp., and the percentage infestation at threshing in some cases in 1942 was 30–40. It was about as high also in experimental plots in which different varieties were being grown. Infestation was apparently less on low-growing varieties of field peas and was negligible on peas interplanted with beans. The yield was increased by planting peas on soil that had been regularly manured with potash, but the infestation was then also greater. No explanation of these apparent inconsistencies is known.

GERRITSEN (J. D.). **Levenswijze en bestrijding van het kersenmotje.** [The Bionomics and Control of the Cherry Moth.]—*Tijdschr. PlZiekt.* **49** no. 4 pp. 119–123, 5 refs. Wageningen, 1943.

Observations in 1941–43 showed that the insects responsible for injury to the flowers of cherry in Holland are *Operophtera brumata*, L., which is the most harmful, *Tortrix* (*Cacoecia*) *podana*, Scop., and *Spilonota ocellana*, Schiff., which are of little importance, and a species of *Argyresthia* for which, following German authors, the name *A. ephippella*, F., is used [*cf. R.A.E.*, A **22** 37, etc.], though English authors consider the species injurious to cherry in Britain to be *A. nitidella*, F. [**31** 140, etc.]. The latter was recorded by Snellen (1882) as restricted to hawthorn [*Crataegus*]. Notes are given, largely from the literature, on the life-history of this moth, which causes considerable injury to cherry. The larvae appear at blossoming time and enter the flower buds; they were present from 25th April to 20th May in 1941 and from 9th to 27th April in 1943. They become full-fed in 2–3 weeks and pupate in cocoons in the soil. The adults emerge 3–4 weeks later, at the end of June, and eggs are laid between the bud scales, in fallen leaves and in other sheltered sites. Wimhurst stated that most of the eggs of *A. nitidella* hatch before winter [*cf.* **16** 615], but, according to Jancke, eggs of *A. ephippella* do not hatch until the buds are ready to open [**22** 37].

A dormant spray of 10 per cent. tar distillate (fruit-tree carbolineum) has been recommended for control, and experiments in 1941–42, the results of which are shown in tables, showed that concentrations of 7·5, 6 and even 5 per cent. very considerably reduced the numbers of flowers attacked. In tests on substitutes for tar distillates, 1 per cent. Elgetol [a preparation containing sodium dinitro-o-cresylate] gave satisfactory results against both *Argyresthia* and *Operophtera*, but 0·3 per cent. lead arsenate applied just before blossoming gave little control and a copper preparation was useless.

FRANSEN (J. J.). **De gevoeligheid van zijderupsen voor derris- en pyrethrum-stuifmengsels.** [The Susceptibility of Silkworms to Derris and Pyrethrum Dust Mixtures.]—*Tijdschr. PlZiekt.* **49** no. 4 pp. 126–129, 1 ref. Wageningen, 1943.

An account is given of laboratory tests in 1942 to ascertain whether silkworms [*Bombyx mori*, L.] are suitable test insects for evaluating dusts containing derris or pyrethrum. The silkworms were dusted on a flat surface, to estimate the contact effect, and placed in petri dishes together with dusted mulberry leaves, to estimate a possible stomach effect, and the dusts were applied at a rate equivalent to 22·5 lb. per acre. The results, which are given in tables, showed that derris dusts containing 0·25, 0·125, 0·0625 and 0·03125 per cent. rotenone caused no mortality when applied as contact insecticides, but 100, 90, 80 and 20 per cent., respectively, when applied as stomach poisons, as compared with no mortality in controls dusted only with talc, but it appeared in later tests that this apparent stomach effect was due to an inhibitory effect of the dusts on the mouth-parts, since little or no feeding took place and the larvae died no sooner than others deprived of food. The percentages of larvae killed by pyrethrum dusts containing 0·00625, 0·025 and 0·1 per cent. pyrethrins were 0, 50, and 100 when they were applied as contact insecticides and 100 in all cases when applied as stomach poisons. It is concluded that silkworms are resistant to derris and more resistant to pyrethrum than most insects.

KUENEN (D. J.). **Spint op vruchtboomen.** [Mites on Fruit Trees.]—*Tijdschr. PlZiekt.* **49** no. 4 pp. 130–131. Wageningen, 1943.

The results are summarised of observations on the bionomics and control of *Paratetranychus pilosus*, C. & F. (*Metatetranychus ulmi*, auct.) on fruit trees in Holland, chiefly in an experimental orchard in Zeeland. Weekly counts of the numbers of mites and eggs present per 100 leaves showed that many mites and few eggs alternated with many eggs and few mites. These peaks represented separate generations and occurred at intervals of 3–4 weeks. The number of generations a year was dependent on climate and food, and in no season were there more than five ; in some cases in 1941 there were only three. The mite population varies with the variety of tree, and the degree of discoloration of the leaves is not always a criterion of population level, as is sometimes thought, since it varies with the thickness of the leaf cuticle. In general, leaves having a thick cuticle, such as those of pear, show much less discoloration than do leaves having a thin cuticle. In varieties of plum, the numbers of mites are correlated with the thickness of the cuticle. The nature of the stock also affects the development of the mite, though less than does the nature of the scion. The influence of climate was clearly reflected in the curves for 1941 and 1942. Warm weather accelerates development, but the actual number of mites on a tree was more dependent on rainfall, which destroys many of them, especially when combined with strong wind.

Cultural measures designed to improve the growth of the tree favour the development of natural enemies of the mite, and since many of these are killed by the control measures usually applied against it, the survivors suffer less through competition. Of the sprays commonly applied to fruit trees, lime-sulphur is the only one that kills the mites, and it is not effective against the eggs. Summer oils kill both mites and eggs, but are seldom used because in combination with lime-sulphur, or even when applied within three weeks of it, they cause severe scorching. Since the mite is thus able to multiply, dormant oils are being increasingly used against it, but lime-sulphur should still be applied in summer. The commonest natural enemies, a beetle and a bug, are most numerous in well cultivated orchards where infestation is heavy,

while in neglected or poorly cultivated orchards, a predacious mite occurs, which attacks the early stages and prevents the development of large populations. On the basis of the population curves, a few growers were advised in 1942 when to apply sprays of lime-sulphur. The results were favourable, and it is hoped to extend the service.

MAAN (W. J.). **De preiinsecten.** [Leek Insects.]—*Tijdschr. PlZiekt.* **49** no. 4 pp. 132–133. Wageningen, 1943.

Hylemyia (*Chortophila*) *antiqua*, Mg., and *Acrolepia assectella*, Zell., cause considerable injury to leeks in Holland, particularly those grown on light soils. *H. antiqua* overwinters in the pupal stage in the soil, and the adults emerge at the end of May or the beginning of June, the males somewhat before the females. The females oviposit about ten days after emergence, and lay their eggs in groups of about six between the outer leaves. The larvae hatch in four or five days and feed on the underground parts, frequently killing young plants; they then migrate through the soil to others. Pupation occurs in the soil at depths of about 3–5 ins., and some of the puparia give rise to adults in July and August, while others overwinter. The third generation is still smaller, and the amount of damage done by larvae of the second and third generations is usually not great. The best method of control is treatment of the seed with mercurous chloride (calomel) [*cf. R.A.E.*, A **34** 67], but this material is expensive and not readily obtainable. The adults can be killed by poison baits, but their use is of little value without the co-operation of growers over a large area.

A. assectella overwinters in the adult stage beneath dead leaves, and the overwintered females deposit their eggs at random on the plants at the end of April or the beginning of May. The larvae mine the leaves, and if they reach the heart of the plant, usually kill it. In one case, 22 larvae were found in one plant. They pupate in cocoons on the surface of the leaves. There are three generations a year, and the greatest injury is caused by the last two, which are present in July–September. *A. assectella* is usually regarded as more harmful than *H. antiqua* because it attacks and kills plants in a later stage of growth. For control, a spray of 0·2 per cent. nicotine with a spreader is recommended, though careful timing is essential.

SCHÄRFFENBERG (B.). **Der Einfluss von Humusgehalt und Feuchtigkeit des Bodens auf die Frasstätigkeit der Elateridenlarven.** [The Influence of Humus Content and Moisture of the Soil on the Feeding Activity of Elaterid Larvae.]—*Anz. Schädlingsk.* **18** no. 12 pp. 133–136. 1942. (Abstr. in *Tijdschr. PlZiekt.* **49** no. 4 p. 134. Wageningen, 1943.)

An account is given of experiments in Germany to test the view that wireworms are less injurious in soils that are damp and rich in humus. Rye plants in pots of rich garden soil or unmixed sand, of which the moisture content was 20, 40, 60 or 90 per cent. of saturation, were exposed to attack by larvae of *Agriotes lineatus*, L., *A. obscurus*, L., *Corymbites* (*Selatosomus*) *aeneus*, L., *C. pectinicornis*, L., and *Athous obscurus*, Payk. (*haemorrhoidalis*, F.). Ten days later, the numbers of plants destroyed were about equal in all the pots of sand and the driest earth, but decreased progressively as the moisture content of the other pots of earth increased, and injury was only slight in the wettest earth. These results were confirmed in a similar test with slices of potato. In a field experiment carried out during a dry period when the shade temperature ranged from 28 to 32°C. [82·4–89·6°F.], lettuce plants in small plots of which the moisture content was maintained at 80–90 or 20–30 per cent. of saturation were exposed to large populations of *Agriotes lineatus*, *A. obscurus* and *Corymbites aeneus*, and the numbers of plants killed were counted daily. The losses

were about 50 per cent. in the wet plots and 70 per cent. or more in the dry ones. It is concluded that in soil rich in humus, wireworms are saprophagous, provided that there is sufficient moisture to maintain their food in solution. Some protection may therefore be given by watering rich soils during periods of maximum attack.

MAAN (W. J.). **De groote dennensnuittor als aantaster van boonen.** [*Hylobius abietis* as a Pest of Beans.]—*Tijdschr. PlZiekt.* **49** no. 6 p. 171. Wageningen, 1943.

Considerable injury was caused to the pods of beans growing in allotments at Weesp, Holland, in August 1943 by the feeding of adults of *Hylobius abietis*, L. The weevils had probably emerged from pine logs stacked near-by, in which tunnels made by the larvae were numerous.

HUYSMANS (C. P.). **Levenswijze, voorkomen in 1943 en bestrijding van de appelbloesemsnuitkever** (*Anthonomus pomorum* **L.).** [Life-history, Occurrence in 1943 and Control of the Apple-blossom Weevil, *A. pomorum.*] —*Tijdschr. PlZiekt.* **50** no. 1 pp. 1–19, 2 pls., 4 figs., 4 graphs, 16 refs. Wageningen, 1944.

The author reviews the conclusions of various workers as to the harmfulness or otherwise of *Anthonomus pomorum*, L., on apple [*cf. R.A.E.*, A **29** 69, etc.], and states that a moderate infestation reduces fruit-production if the trees are weakened by other causes, while 90 per cent. or more of the flower-buds are sometimes infested in Holland. The adults of this weevil are briefly described, and notes are given on its bionomics. The egg, larval, prepupal and pupal stages lasted 8–12, 14–21, 4–5 and about 10 days, respectively, and the adults seek hibernation quarters about a month after emergence. Some 25 per cent. of them remain in sheltered positions on the tree. A survey in 1943 showed that the weevil was present in most of the apple-growing districts of Holland, the percentages of buds infested ranging from 0 in West Brabant to 31 in Middle Brabant and averaging 18·3 in 117 infested orchards. It was commonest in wooded districts, but the degree of infestation was not affected by the age, shape or variety of the trees, except in the case of one late variety, which was heavily infested.

Practices that afford some control are jarring the trees in spring and destroying the adults dislodged, collecting and destroying infested buds, and applying bands of sacking, preferably of double thickness, just below the crowns of the trees in June, to trap weevils in search of hibernation sites. The bands should be examined monthly and any weevils in them destroyed by immersion in boiling water, tar distillate (fruit-tree carbolineum) or dinitro-o-cresol. The bands can also be sprayed on the trees, but destruction is then less certain. Winter sprays of tar distillate, dinitro-o-cresol, mineral oil or combinations of the last two have generally given poor results, but a late winter spray of dinitro-o-cresol, applied when the adults are resuming activity, has been effective in fine weather, when the weevils leave their hiding places.

In an experiment on the effect of late winter sprays against weevils hibernating on the trees, sprays of 1 per cent. Selinon (which contains dinitro-o-cresol), 7·5 per cent. tar distillate and 1 per cent. Gesarol [a preparation containing DDT] were applied to the loose bark on the trunks on 1st March, while the buds were still dormant. On the following day, the treated bark was carefully removed and counts were made of the dead, moribund and normal weevils in it. It was found that the sprays had not penetrated to all parts, and weevils that had obviously received no spray were not included in the results. Some of these were also dead or moribund. The results showed that the mortality percentages for the three sprays were 72, 51 and 40, respectively, as compared with

27 for controls. The proportion of moribund weevils was greatest on the trees sprayed with tar distillate, and this is attributed to the slowness of its action. Gesarol was also slow in action. Since the actual numbers of weevils per tree were less on those sprayed with tar distillate and Gesarol, a laboratory test was carried out to ascertain whether the weevils are able to escape after treatment with them. The three sprays and water alone were applied to batches of 20 weevils, which were then placed in gauze cages with holes permitting them to escape. Two days later, the numbers remaining in the cages and (in brackets) the numbers dead were 18 (14) for Selinon, 7 (2) for tar distillate, 2 (0) for Gesarol, and 3 (0) for water alone. A further test of the action of the sprays showed that Selinon acted rapidly and is therefore the best material for a winter spray, tar distillate somewhat more slowly and Gesarol more slowly still, though it gave a higher percentage mortality after five days than tar distillate. When batches of 20 weevils were confined for six days with twigs that had been sprayed with the three insecticides and allowed to dry, to test their residual action, Selinon and Gesarol both gave high mortalities, but tar distillate was ineffective. A Gesarol dust was somewhat more effective than the spray.

Gesarol dust was further tested in the field in an orchard of mixed varieties that had received a spray of Selinon on 20th March. Most of the trees were dusted twice, on 3rd and 12th April, and the first application was followed by rain. The results showed that the percentage of buds infested was less than 1 on all varieties except one that had reached the green-bud stage, on which it was 5, as compared with 15 on the controls. Some trees received the second application only, and these were in general heavily infested, probably owing to the buds being too advanced in growth. The percentage infestation on trees on which the buds had not yet burst that were sprayed on 14th April with 1 per cent. Gesarol with a spreader was 1 or less, as compared with 20–25 in the controls.

Parasites bred from infested buds in 1943 were identified as *Ephialtes* (*Pimpla*) *brevicornis*, Grav., *Bracon discoideus*, Wesm., *Habrocytus tenuicornis*, Först., and *Trichosteresis* sp., but it was not known whether all these were primary parasites. The total percentage parasitism was only 0·8. A few parasitised adults were observed in March.

VAN ASPEREN (K.). **Levenswijze en bestrijdingsmogelijkheden van de appelbloesemsnuitkever,** *Anthonomus pomorum*, **L.** [The Life-history and the Possibilities of Control of the Apple-blossom Weevil, *A. pomorum*.]—*Tijdschr. PlZiekt.* **50** no. 1 pp. 19–22, 4 refs. Wageningen, 1944.

An account is given of observations on the life-history of *Anthonomus pomorum*, L., carried out on a caged bush apple tree at Wageningen in 1943. The adults emerged from hibernation during the first half of March and fed on the buds. This is often referred to as maturation feeding, and the term is applicable to the females, but not to the males, which are sexually mature on emergence. Pairing occurred in the last week of March and the first week of April, and oviposition began during April when the fruit-buds were partly open. The process of oviposition is described. The egg, larval and pupal stages lasted about 8, 28 and 8 days, respectively, and development from the egg to the emergence of the adults from the buds 6–7 weeks. The newly emerged adults fed to some extent on the leaves and sought hibernation quarters in June. Development was completed about a week later in late varieties than in early ones.

Most authors have considered the weevil to be injurious [*cf. R.A.E.*, A **29** 69], but it has been stated by Aristov that infestation must reach 80 per cent. to cause damage of economic importance [**20** 233]. This level is seldom reached in Holland, but since injury to the buds is also caused by larvae of *Operophtera* (*Cheimatobia*) *brumata*, L., and Tortricids and observations there have shown

that a larva of *Anthonomus* seldom occurs in a bud together with other pests, total infestation frequently exceeds 80 per cent., and *Anthonomus* is responsible for part of it. In addition to the direct loss of crop, there is also some indirect loss due to reduction in pollination.

Control of the weevil is difficult. Adhesive bands give poor results, since the adults are good fliers, and jarring and the use of trap bands of sacking [*cf.* preceding abstract], which have to be examined every month, are time-consuming. Sprays of dinitro-o-cresol have been recommended against the overwintered adults, but since these do not all emerge from hibernation at the same time, the sprays have to be repeated. Four species of parasites [*cf.* preceding abstract] were bred from infested buds in two districts in 1943, but the percentage parasitism was only 1–2.

VAN MARLE (G. S.). **Aantasting van begonia's door mijten, behoorende tot het geslacht *Tarsonemus* Can. et Fanz.** [The Infestation of *Begonia* by Mites belonging to the Genus *Tarsonemus*.]—*Tijdschr. PlZiekt.* **50** no. 2 pp. 25–39, 4 pls., 75 refs. Wageningen, 1944.

Mites of the genus *Tarsonemus* infesting winter-flowering *Begonia* at Aalsmeer, in Holland, were identified by the author as *T. latus*, Banks. The injury consisted in bronzing of the lower surfaces of the leaves, but the leaf-veins were not involved, as they are in the case of infestation by thrips. The nomenclature of this mite is discussed, all stages are described and figured, characters are given distinguishing it from *T. pallidus*, Banks, which has also been observed on *Begonia* in Holland, and notes are given on other ornamental plants on which it was observed. Records of *T. latus* on *Begonia* and other plants in different parts of the world are reviewed from the literature. In tests on *Begonia*, the only satisfactory control measures were dusting with sulphur and fumigation with methyl bromide at the rate of 1 oz. per 50 cu. ft. for six hours at 15–17°C. [59–62·6°F.].

STELLWAAG (F.). **Eine einfache und wirksame Bekämpfung der Kleidermotten.** [A simple and effective Control of Clothes Moths.]—*Anz. Schädlingsk.* **19** no. 10–12. 1943. (Abstr. in *Tijdschr. PlZiekt.* **50** no. 3 pp. 71–72. Wageningen, 1944.)

In tests on the value against clothes' moths of DDT in Gesarol preparations, newly hatched larvae all died in 24 hours when allowed to crawl on cloth that had been dusted with this material or had been sprayed with it and allowed to dry. Older larvae were more resistant, and the eggs were unaffected. The adult moths were very rapidly killed by contact with Gesarol, which is therefore strongly recommended for treating clothes, carpets, etc.

DOEKSEN (J.). **Een nieuwe beschadiging van maiskolven.** [A new Type of Injury to Maize Cobs.]—*Tijdschr. PlZiekt.* **50** no. 4 pp. 107–108, 8 pls., 4 refs. Wageningen, 1944.

Injury to the developing seeds of maize observed in Holland in 1942 and 1943 was found in the latter year to be apparently due to the feeding of *Orius majusculus*, Reut., which is usually predacious on other insects. Examples of this Anthocorid or cast skins were found between the bracts on all the injured cobs examined, but not on normal ones, and the bugs apparently fed on the seeds through the innermost bract. The fluid that they injected contained enzymes able to split cellulose, starch and protein, and the resulting injury to the tissues is described. The percentage germination of damaged seeds was reduced to as little as 50, as compared with 70 for normal seed, and their susceptibility to fungous disease was greatly increased.

GOLDING (F. D.). **The Occurrence of** *Platyedra gossypiella*, **Saund., in Nigeria.**—*Emp. Cott. Gr. Rev.* **22** no. 1 pp. 1–2, 5 refs. London, 1945.

The object of this note is to record the recent discovery of *Platyedra gossypiella*, Saund., in Nigeria. It is not common in the American cotton belt of the Northern Provinces, where two adults were reared from long-cycle larvae in stored cottonseed in July 1944, and a larva was found in a boll in the same area in January 1945, but it is widely distributed in areas in the Oyo and Abeokuta Provinces where native cotton (*Gossypium barbadense* and *G. peruvianum*) are grown and where it appears to have been present for several years. Harvested seed-cotton examined at Ibadan during January contained many short-cycle larvae, but none in diapause. Long-cycle larvae were found, however, in cotton-seed ginned in late February and in bolls on native farms in March, and the initiation of diapause is attributed to atmospheric conditions brought about by hot, dry winds that were prevalent for ten days in February. Evidence is given indicating that *P. gossypiella* was introduced into Nigeria subsequently to 1939. It has also been found recently in Upper Senegal [*R.A.E.*, A **33** 165], the Ivory Coast and Dahomey.

PAPERS NOTICED BY TITLE ONLY.

GHESQUIÈRE (J.). **Un** *Pyroderces* **sénégalais nuisible au mil (Lép. Cosmopterygidae)** [*P. risbeci*, sp. n., infesting panicles of sorghum in Senegal].—*Rev. Zool. Bot. afr.* **33** fasc. 3 pp. 277–278. Brussels, 1940.

GHESQUIÈRE (J.). **Contribution à l'étude des Hyménoptères du Congo belge. VII.—Nouveaux Proctotrupoidea Diapriidae** [including *Loxotropa melanagromyzae*, sp. n., reared from a pupa of *Agromyza* (*Melanagromyza*) sp. mining coffee leaves].—*Rev. Zool. Bot. afr.* **34** fasc. 3–4 pp. 353–362, 30 refs. Brussels, 1941.

SCHOUTEDEN (H.). **Un nouvel** *Eurystylus* [*risbeci*, sp. n., on sorghum] **du Sénégal (Hémiptères : Miridae).**—*Rev. Zool. Bot. afr.* **35** fasc. 3–4 pp. 422–423. Brussels, 1942.

GHESQUIÈRE (J.). **Un nouvel ennemi du mil au Sénégal** [*Cosmopteryx attenuatella* ab. *luteoapicalis*, n., on sorghum].—*Rev. Zool. Bot. afr.* **35** fasc. 3–4 p. 424, 2 refs. Brussels, 1942.

DE SAEGER (H.). **Un nouvel** *Apanteles* **du Sénégal (Hym. : Braconidae)** [*A. risbeci*, sp. n., from larvae of *Prodenia litura*, F.].—*Rev. Zool. Bot. afr.* **36** fasc. 1 pp. 61–63, 1 ref. Brussels, 1942.

LEPESME (P.) & PAULIAN (R.). **Une Tachinaire parasite des larves du monohamme du caféier** [*Phorostoma* sp. parasitising *Bixadus sierricola*, White, on coffee in Belgian Congo].—*Rev. Zool. Bot. afr.* **37** fasc. 1–2 pp. 89–92, 2 figs. Brussels, 1943.

THOMPSON (W. R.). Ed. **A Catalogue of the Parasites and Predators of Insect Pests. Section I. Parasite Host Catalogue. Part 6. Parasites of the Lepidoptera (CI-F).**—10¾×8¼ ins., pp. [1+] 131–258 multigraph. Belleville, Ont., Imp. Parasite Serv., 1945. Price $(Canad.) 2. (Also obtainable from Imp. agric. Bur., 2 Queen Anne's Gate Bldgs., London, price 10*s.*) [*Cf. R.A.E.*, A **32** 106; **33** 128.]

NEAL (P. A.). **DDT Toxicity. A Report on the Toxicity to warm-blooded Animals of Aerosols, Mists and Dusting Powders containing DDT.**—*Soap* **21** no. 1 pp. 99–101, 111, 2 refs. New York, N.Y., 1945. [See *R.A.E.*, B **34** 34.]

DIERICK (G. F. E. M.). **De ovicide werking van 3,5-dinitro-o-cresol.** [The Ovicidal Effect of Dinitro-o-cresol.]—*Tijdschr. PlZiekt.* **49** no. 1 pp. 22–32, 2 figs., 7 refs. Wageningen, 1943. [*Cf. R.A.E.*, A **33** 15.]